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Founded 1874—Fifty-Four Years of Service

Electrical World

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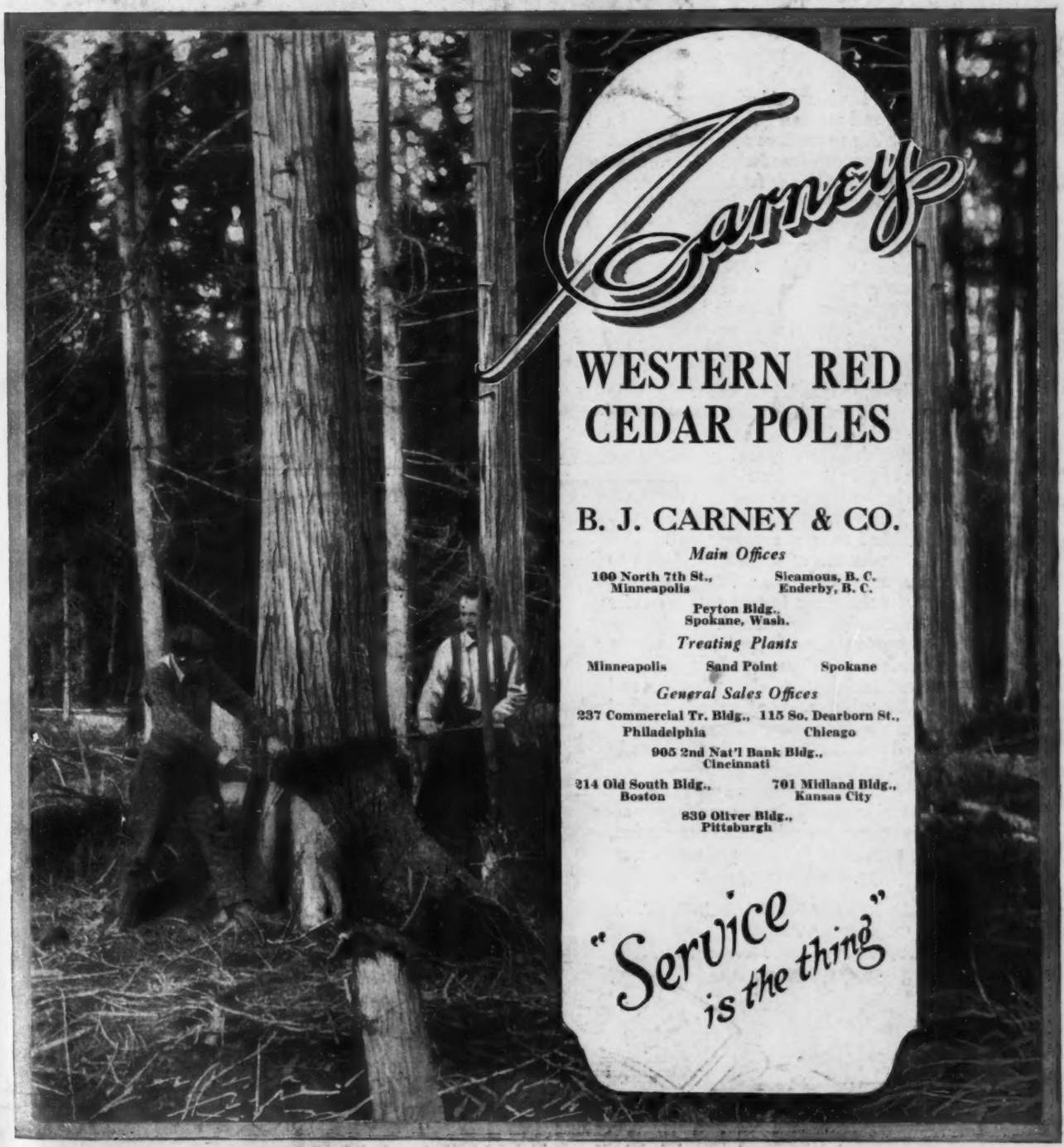


Tools ~ pages from Weston history

Model One Ohmmeter for the measurement of electrical resistance

IT has been said of Weston that its real crowning achievement is its ability to produce the world's finest measuring instruments at such moderate prices.

One manifest reason for this is found in Weston's priceless tool equipment. It is no ordinary tool crib which houses this rich treasure, nor are the tools themselves to be classed with the more or less familiar devices employed in the average plant.

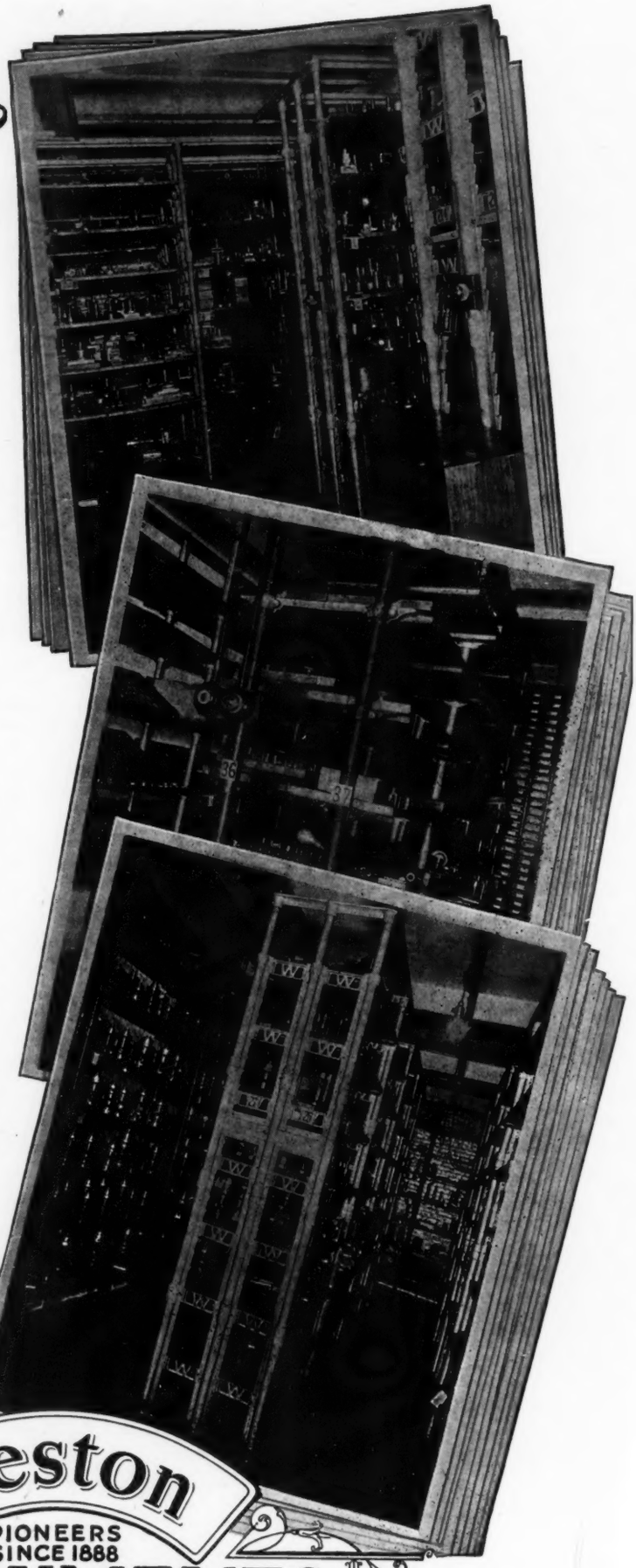
Rather, are these extensive vaults and unique developments of the tool-maker's skill to be likened to a vast reference library of original manuscripts, for they are concerned with an industrial history of unusual authorship.

In these specially constructed fire-proof vaults, only three small sections of which are here shown, are contained the rare and original tools of Weston design and construction which have played so conspicuous a part in the growth of the art of electrical measurement —from its earliest beginnings to the present day.

From these tools any Weston instrument of early design can be furnished to meet a customer's requirement, with the introduction of essential revisions to conform with modern specifications. Moreover, any replacement parts for the oldest instruments in service can be made expeditiously upon demand.

Obviously no outside source of supply, without the benefit of this abundant experience, can be expected to duplicate the essential refinements, close tolerances and high quality of Weston's mechanical and handcrafted operations. Nor can even a close approximation of Weston quality and precision be reached with like efficiency and low unit cost.

This is one of the outstanding reasons why other instrument makers, whose copied designs are largely assemblies made from parts secured in the open market, find it impossible to imitate Weston performance, *or even to come materially under Weston prices.*



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Searchlight Section ...44-47
Engineers' Directory..42, 43
Classified.....70, 72, 74
Alphabetical Index 76

In This Issue

Outdoor Metal-Clad Switchgear.....153
By H. J. HUBER

Main and reserve buses, oil circuit breakers, instrument and auxiliary transformers and connecting buses are inclosed in metal housings mounted outdoors on massive steel structure.

Plans for Lightning Tests.....165
By A. L. ATHERTON

Specific and conclusive answers to existing questions must be obtained, says the author, who outlines field investigations under way in Tennessee and Illinois. Operator and manufacturer have joint responsibility.

Accounting for Depreciation.....169
By W. G. CROSS

Types of reserve and methods of accumulating are outlined with the policies for charging depreciation against reserve. Straight line and sinking fund reserve accumulations are discussed graphically.

Editorials 149
Frontispiece—A Departure in Station Design 152
Consumers' Voltages Along a Secondary 156
Common-Neutral Network.....157
By M. T. CRAWFORD
Interconnection Load Control.....159
Heavy Alley-Arm Construction.....160
The Power Salesman.....161
By B. J. GEORGE
Protecting Lines from Lightning Disturbances 163
Operating Organizations.....164
Carrying Model Farm to Rural Districts 168
Correct Time for Public Relations....171
By EARL WHITEHORNE
Five Minutes' Labor a Day Pays for Electric Service.....173
By M. LUCKIESH
Electric Truck Data Cover Seven Years of Commercial Application.174
Process Steam Supplied Electrically..174
Letters from Our Readers.....175
Digest of Electrical Literature.....176
News of the Industry.....178
Men of the Industry.....185
Financial and Statistical.....187
Business News and Market Conditions 191
Electrical Patents.....196

"Electrical World" Index Available

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Editor

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What Should Be Done with the Information Bureaus?

STOP the fourth man you meet on any corner and ask him how he thinks the public feels at present toward the electric power industry and his answer will probably reflect his own most recent impression. His opinion will be colored largely by the vivid picture of the work of the public utility information bureaus that has come out of the Federal Trade Commission hearings. This being so, the question of the further usefulness of these bureaus is something which should have the very serious consideration of the leaders of the industry. For the bureaus have been left dazed and fumbling, wondering just what *has* happened to them and just what will.

With its propaganda gone conspicuously sour, should the power companies continue to flood the country with self-praise, in the form of news stories and reprinted speeches? Should they permit themselves to even seem to be going on and on with more and more of the very "information" that has aroused the public indignation? For no matter how true the contents may be and how vitally the messages may interest electrical men, the public has indelibly registered annoyance. The power men are striving to explain, but the public apparently does not want to listen. And the public is boss.

Good service, reasonable rates, good citizenship, courtesy—these are fundamentals of the utility business. But the people take all this as a matter of course. They expect it. They feel entitled to it. They are not particularly interested in hearing about it. But they *are* interested in what electricity can actually do for them in their own daily work and lives. As a good influence, then, the public utility information bureau has failed, and the time has come for the industry to turn away from such political measures of indirection and put its reliance upon the quality of its service and the building of its market by straightforward selling.

* * * *

Sheet-Metal Bus Inclosure

IN THE past two or three years a tendency to depart from the classic bus structures and make changes intended to result in economies of station construction, improved operation and increased safety has become apparent. This tendency has been evident in the installation of armor-clad buses and switchgear.

Now comes another idea along this line, an idea that its proponents claim has many of the advantages of the armor-clad bus, together with a few additional virtues. It is simply the inclosure of standard switches and standard bus construction in sheet-metal boxes and runs, doing away entirely with concrete cell work and thus removing the bus and switch accommodations from consideration as a part of the building structure. In essence, the new construction is the substitution of sheet metal for concrete as a bus-structure material. The sheet metal employed is steel mostly, with copper and bronze where eddy currents might introduce objectionable heating.

This method of construction retains the feature of safety so well provided for in armor-clad gear. Additional advantages claimed for it are that it employs air for insulation instead of a semi-solid or oil; that by the use of short pedestals or mat insulators the inclosing structure may be utilized as a fault bus, and that all parts may be fabricated to design in the utility's own shops or by any metal worker. These and other virtues claimed for this type of construction are admittedly open to argument. Probably a facetious critic might suggest that a can opener would become necessary to get at any part of the bus in a hurry. But, can opener or not, the idea is worthy of serious thought. In a short time, after the installation now being made by a large utility company is completed, a solid basis will be available on which to appraise it.

* * * *

International Exchange of Experiences

A COUPLE of years ago a number of groups representing the electric light and power industry of different countries concluded it would be well to associate themselves for the purpose of gathering statistics and exchanging data and experiences, very much as the National Electric Light Association does in this country. At first only two or three countries co-operated, but gradually, as interest was awakened and it was recognized that some central organization was necessary, the Union Internationale des Producteurs et Distributeurs D'Energie Electrique was created, with headquarters in Paris.

The United States was invited to join the group, but acceptance was withheld until the worth and importance of the new organization were demonstrated. After a thorough investigation the National Electric Light Association joined the union and designated Messrs. Samuel Insull, Charles L. Edgar and John Lieb as representatives.

At the present time there are seventeen or eighteen national groups represented in the international organization, and last year an important meeting was held at Bellaggio, Italy. Some countries have not yet joined because they have no outstanding organization which adequately represents the electric light and power industry; but in some cases national groups are being formed which look upon the union sympathetically, recognizing its

advantages, although they have not as yet attached themselves to the international organization.

It is recognized that there are many subjects of international importance in the field of power production, transmission, distribution and utilization and that there are advantages to be secured by the interchange of data and experiences. The meeting just held in Paris amply demonstrated the value of such international conferences, even though in the case of the United States we are apt to give more than we receive for very obvious reasons. However, the meeting of minds, the understanding of problems and viewpoints of the various nations, not to mention the difficulties confronting many peoples of the world, mean much to the electrical industry and contribute immeasurably toward the amity of nations. Being trebly blest with natural resources, experience in the economical production and distribution of electricity at potentials higher than are to be found elsewhere, and in the diversified utilization and applications of electrical energy, we are as a people in duty bound to impart to the rest of the world what we have learned and experienced, so that all the world may enjoy the civilizing and alleviating benefits which the wider use of electricity makes possible.

* * * *

Artificial Light Is Superseding Daylight

A FEW years ago careful investigations of the cost of daylight brought the startling conclusion that natural lighting in many buildings was costing much more than good artificial lighting. It was then predicted that daylight would eventually be considered more carefully with regard to cost, convenience and dependability. There was no intention of advocating the abandonment of daylight where it could be obtained at reasonable cost and in sufficient quantity. The object of the work was to reveal certain economic factors and to protect the user of light from costly errors due to habit. Artificial light had been decreasing so rapidly in cost and at the same time increasing so greatly in controllability and quality that the time had arrived for making comparisons.

In congested districts, where ground and floor area and also wall space are valuable, some of the daylighting installed through habit or in earlier years is now relatively too costly. Furthermore, artificial lighting is very generally necessary on account of the certain failure of daylight once each day and of its undependability at all times. In many stores and offices it is always inadequate. In certain areas in large stores and factories it is insufficient in intensity most of the time. Excepting in single-story factories or on the top story the roof cannot be utilized efficiently for admitting daylight. Even in such cases a costly method of roof construction often is not economically justified for lighting in comparison with the cost of artificial lighting.

Several large auditoriums, one notable art museum and other new buildings have been designed without daylight in part of the structure or even in the entire building. A large store has just given up its windows in certain places, the space being more valuable than the meager daylight. Many other examples could be cited. The time has arrived for giving more attention to the economic value of natural lighting compared with artificial lighting. At first thought it is slightly shocking to give up daylight, but a consideration of all aspects of the situation convinces one of the practicability of the idea in many cases. It is a natural consequence arising from our tendency to concentrate into cities. Fortunately, artificial lighting solves the problem, because in many cases it is cheaper and better than the natural lighting indoors.

* * * *

Costs and Prices

REPEATED instances are found where prices are based on erroneous cost accounting. In a recent case bids based on a sample product were asked and several manufacturers submitted them. The price range was more than 100 per cent, and the curious purchaser, upon investigation, found that each manufacturer had made his price by adding a fair profit to his cost analysis. The fact was very evident that most of the manufacturers had no definite idea of costs of production and omitted or inserted items depending on their individual system of cost accounting.

These methods of pricing are used frequently even on standard products. Again, one company might base costs on carrying a large inventory in stock, so that service could be given instantly to customers, while another company might carry no stock and base its costs on direct production to order. How much should the purchaser allow the company which carries his insurance reserve? Overhead charges, development charges, contingent charges and many other items of cost are introduced in the manufacture of any product or the giving of any service, and it is very difficult to fix values for some of the items. Yet in competitive lines the greatest stabilizer for business is the adoption of a uniform method or system of cost accounting. The items that go to make up the total costs of any product can be listed and an individual manufacturer can use this guide to fix cost values and thus get reasonable prices established.

Every branch of the electrical industry would do well to formulate and adopt a uniform cost accounting method, for this tool and that other valuable tool, statistics of production, make possible a stability and a prosperity that are impossible with haphazard business methods. Proper cost accounting is basic in any progressive business.

* * * *

Business Outlook Good in Pacific Southwest

THE prospect for better times in Arizona, New Mexico and west Texas, where conditions have not been good for several years, is unusually bright, particularly for the electrical industry. This was revealed on a recent trip through this region by a representative of the ELECTRICAL WORLD.

Phoenix for the first time in several years is showing considerable activity. Several large buildings are under construction and a number of others will be started soon. As has been noted in our news columns, the Salt River Valley Water Users' Association will start work almost immediately on a 12,000-kw. hydro-electric development at Stewart Mountain, 12 miles below the Mormon Flat plant completed about a year ago. There is also a good prospect of the Verde development going ahead, and this will have an ultimate plant capacity of approximately 100,000 hp. The Coolidge Dam for the Casa Grande

irrigation district is nearly completed and work will soon start on the power plant. In addition to several million dollars to be spent on the Stewart Mountain development, the Salt River Valley Water Users' Association will spend this year $1,300,000 in building 600 miles of 4,000-volt distribution lines to carry service to all the farms in the fertile Salt River Valley. This will mean large sums of money spent for distribution materials and wiring supplies as well as the appliances which farmers will purchase to utilize the service.

Copper-mining interests of Arizona and New Mexico are reported to be spending more money this year for electrical equipment and supplies than has been spent in the aggregate for several years past. Large copper interests have announced construction of a 5,000-kw. electrolytic copper refinery in El Paso; an oil refinery has just been completed, and other industrial development is in prospect. Plans are well matured for building a power plant at Elephant Butte Dam and for a 70-mile transmission line to connect the plant with the system of the El Paso Electric Company, which has contracted to absorb the power.

These and other activities in the Southwest should be very encouraging to the electrical industry. Central stations of the region, heretofore restricted in growth, should take full advantage of the load-building opportunity offered by more payrolls, greater wealth and increased population.

* * * *

Dielectric Breakdown Insufficiently Explained

THERE are few problems in dielectric behavior which attract greater interest than that of the mechanism of the failure of insulation. The influence of temperature rise on dielectric strength grew gradually in the consciousness of electrical engineers, receiving concrete expression in the hands of Steinmetz and Wagner. The limitations of this theory have now been clearly recognized and it is known to be inadequate as a complete explanation of the underlying mechanism. In a recent number of the *Archiv fur Elektrotechnik* Rogowski presents an interesting suggestion of breakdown in solids as the result of ionization by collision.

It appears that in all crystalline substances there are always present a number of small cleavages and canals scattered in great plenty throughout the mass of the crystal. These small areas of intercrystalline space are invisible under the microscope. They can be detected only by the most refined methods of the absorption of gases, resulting in discoloration of the crystal. The presence of ions in these spaces has also been shown, as well as the probable length of the spaces. Rogowski studies the values of velocity which may be attained by an ion when moving the length of one of these spaces. He reaches the conclusion that the free ions present may attain sufficient velocity to cause temperature instability in the crystal under the shock of the ions, which thus generates additional ions in adjacent cleavages, leading thus through a progressive condition up to breakdown.

One of the greatest difficulties in theories of dielectric breakdown has been to account for the wide differences, factors from 20 to 100, between the values of observed and computed dielectric strength. The values of dielectric strength, as computed by Rogowski under the theory described above, are of the same order of magnitude as those found in careful experiment. The explanation as proposed is so far limited to only a few crystals and we are still far removed from a well-developed theory of breakdown. Nevertheless, that we should have so satisfactory an explanation on the basis of ionization by collision in even a few substances is a long step in advance.

* * * *

Looking Forward in Interconnection

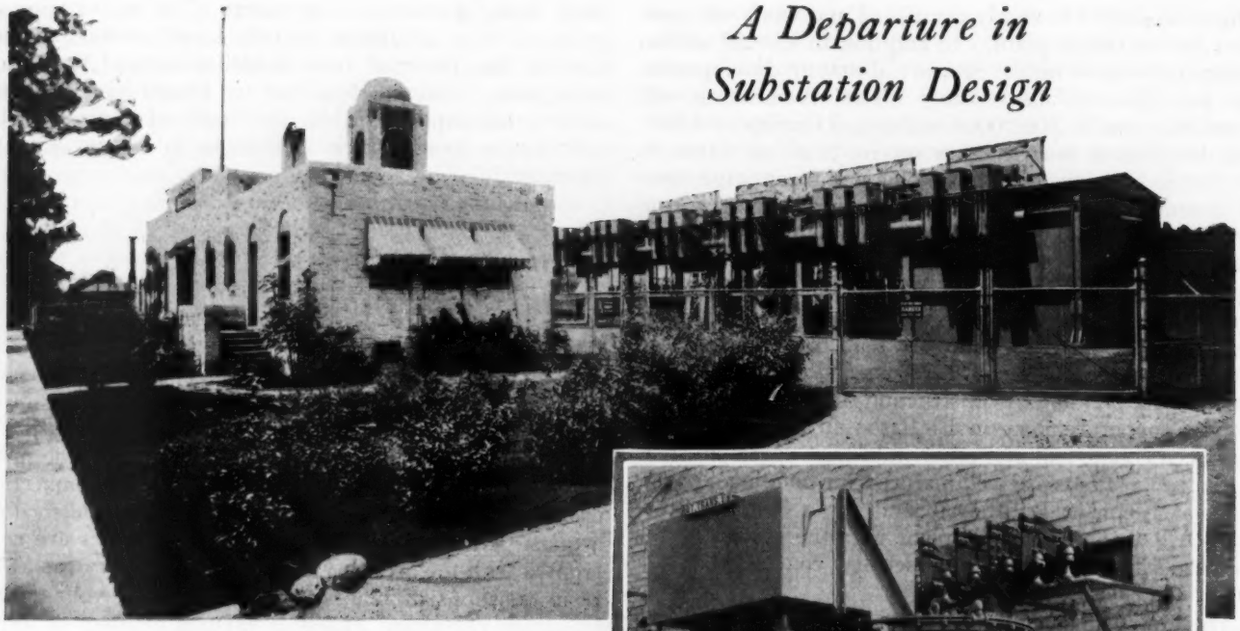
AS LONG as loads on power systems change in amount and time the operating engineer must reconcile himself to dealing with ever-varying problems. Most systems are growing substantially from year to year. It would be pleasant, perhaps, to be able to put aside one's slide rule for a few months' respite from interconnection problems once an economic tie-in has been established on a quasi-permanent basis. But many engineers are confronted with the necessity of never getting very far away from questions of plant and line adequacy, voltage and frequency regulation, fitness of existing methods of interchange, cost control and other matters of unceasing interest and importance in this field. The larger the network involved, the greater the need of vigilance, lest quality of service suffer or costs get out of hand.

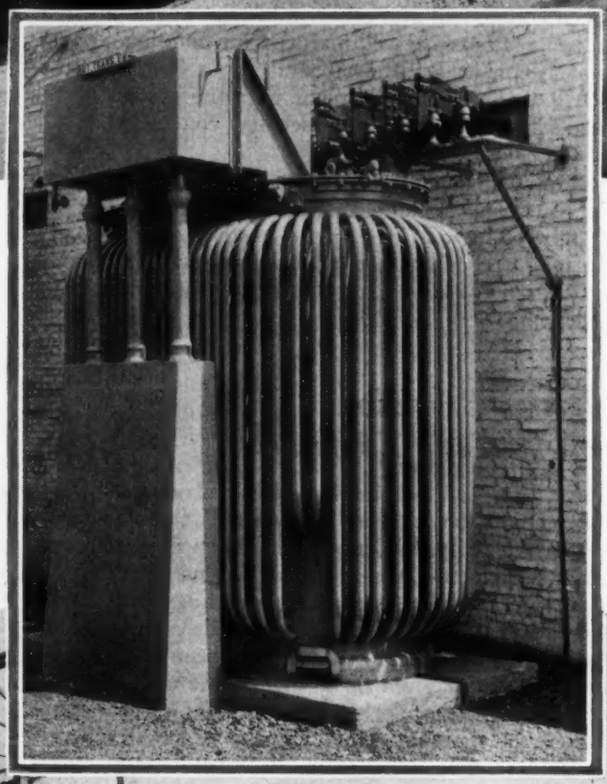
It is gratifying to observe the engineering attention now being devoted to the future development of important interconnections. Operating executives have become regionally minded, with some amazing exceptions. In line with this forward-looking attitude, much scrutiny is being given to prospective ratios of output and interchange from hydro and steam plants, to the trend of diversity figures in relation to plant-capacity savings, to the relation of improved designs in local stations to system operation, to the ratio of transmission capacity, substation ratings and generating plant productive abilities to load shifts and changes, and to the anticipated effects of accelerating tie-line construction and of adding new participating companies to the total system.

One must be prepared to encounter marked changes from the *status quo* as studies along the above lines proceed. Preconceived ideas as to the relative value of hydro and steam supply are apt to be modified, for example. With the growth of component systems and loads it may easily happen that the amount of excess power available from existing hydro plants will decrease. Such excess is likely to be absorbed over a period of years by the natural growth of the individual systems entirely apart from interconnection. Other hydro stations may be brought into the network from time to time, but these cannot always be counted upon to maintain an excess hydro-power margin.

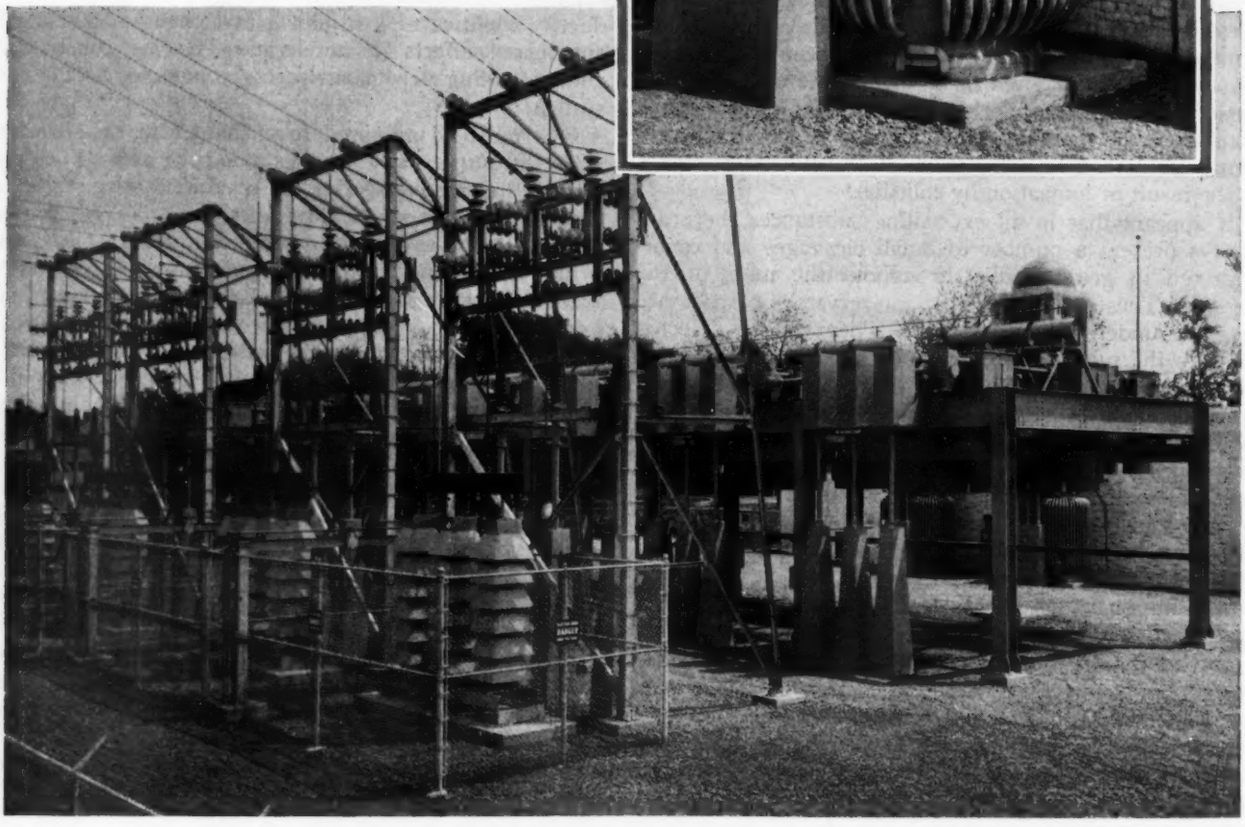
As systems grow the capacity saving due to diversity between systems may be expected to keep pace if the individual load factors remain about the same. The saving in the capacity necessary to provide reserve for breakdowns and for growth which results from pooling system reserves may be expected to increase with overall system growth. As the systems of the participating companies grow and better local stations are built, the operating savings possible from the transfer of energy from one group to another may tend to decrease. In such case the value of interconnection from the service insurance standpoint may become relatively large.

A Departure in Substation Design





AT THE Wheaton (Ill.) substation of the Public Service Company of Illinois conventional design has been largely thrown to the wind, except at the line-entering structures and in the indoor portion of the installation. A glimpse of the unusual features—metal-clad switchgears, bus structures, and instrument transformers — is afforded in these views. The following pages go into more detail.



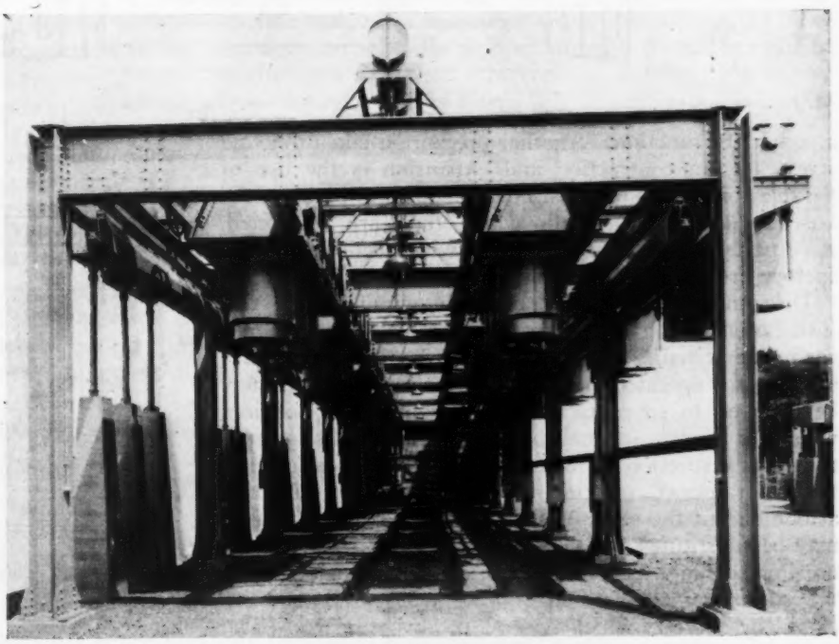
Outdoor Metal-Clad Switchgear

At the Wheaton Substation

Main and reserve buses, oil circuit breakers, instrument and auxiliary transformers and connecting buses are inclosed in metal housings mounted outdoors on massive steel structure

By H. J. HUBER
General Electric Company

A DISTINCT departure from conventional design was made in designing and equipping the 33-kv. outdoor switching station recently placed in service at Wheaton, Ill., by the Public Service Company of Northern Illinois. The distinguishing characteristic is that all live parts, including the 33-kv. buses and connections, are completely surrounded by metal connected to ground so that casual contact with the high-voltage conductors is impossible. If a fault should occur within the sheath it would be prevented from spreading to other circuits. All operations are interlocked mechanically or electrically or both. While the equipment will be operated at 33 kv., it was designed for 37 kv. and was subjected to a one-minute test of 85,000 volts.



End of metal-clad switchgear structure

On the left are the 33,000-volt cables conveying incoming energy. The circuit breaker tanks may be seen hanging from the ceiling. Along the top are conservator tanks. At the rear is the carriage for circuit breaker tanks. On the right are auxiliary transformers.

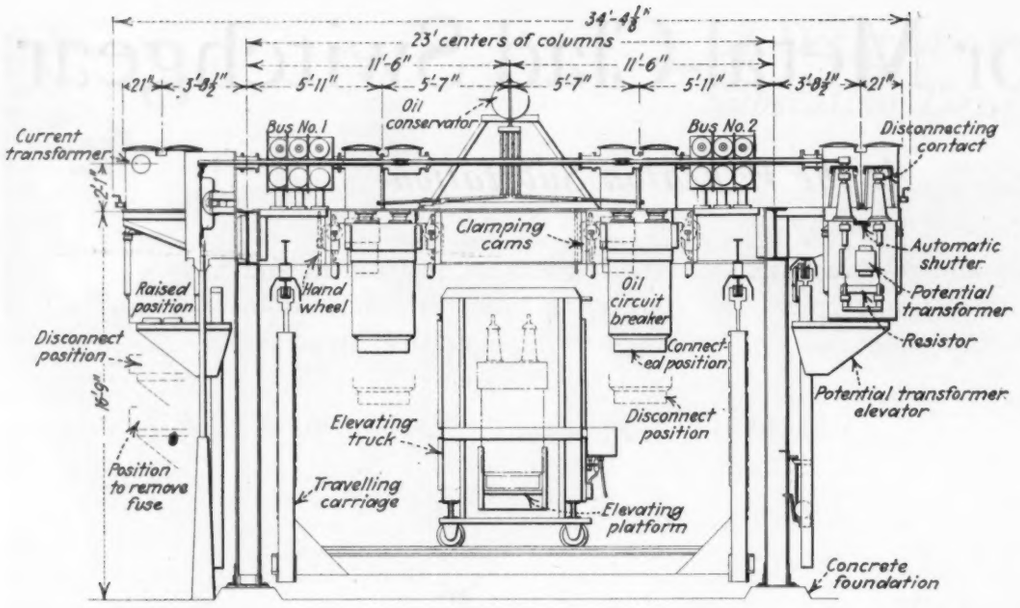
Energy is delivered to the station by overhead lines, terminating at a structure where lightning arresters are installed and the overhead circuits are connected with underground cable leading to the metal-clad switchgear station. The main and reserve buses, oil circuit breakers, instrument and auxiliary transformers are mounted outdoors on a massive steel structure. Control boards are housed in the substation building, from which control leads and secondary wiring are carried to the outdoor switch equipment in conduit and lead-covered cable.

Seven circuits are so connected that they can be fed from either the main or reserve bus. An auxiliary transformer is connected to each bus. Each circuit occupies one bay in the eight-bay steel framework. The additional bay is inclosed with steel sheeting to house an elevating truck and traveling carriage and also serves as an inspection booth.

Grounded metal pipes house the 33-kv. buses. Each of the three phases has its own independent set of pipe inclosures, so that two walls of grounded metal separate the conductors of one phase from those of the two others. At intervals the pipe sections are joined to junction boxes by expansion joints, so that any expansion or contraction will not strain the joint or housings.

Copper tubes wrapped with Herkolite insulation at the factory are used for 33-kv. conductors. Every two or three feet these buses are supported by spools of the same insulation which fit the inclosing tubes with a slight clearance. Four sides of these spools are cut back to permit free circulation of the oil used to fill the space within the junction boxes and between conductors and pipes. Longitudinal and lateral barriers are provided in each junction box so that a leak in any pipe section will be confined to that section. The compartments formed by these barriers are connected through manifolds to three oil conservators identical with those used on transformers — one to each phase. Filter connections are attached to each box, housing and inclosing pipe.

Sufficient insulation and clearance to ground are provided throughout the equipment so that it can run at operating voltage for a short time even though all the oil has leaked out. The oil is chiefly a medium for filling the spaces between the insulated conductors and their inclosures; the provision of additional insulation is only



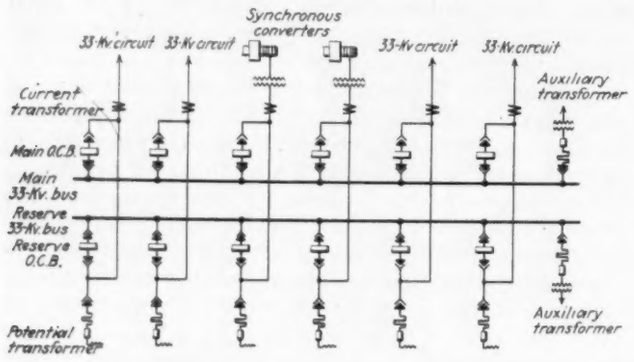
Arrangement of metal-clad equipment

In the vertical cross-section are featured the relative locations of the circuit breakers, buses, instrument transformers, oil conservators and circuit breaker elevator. Below is the plan of just one bay showing the horizontal arrangement of equipment, including buses, connections thereto and expansion joints.

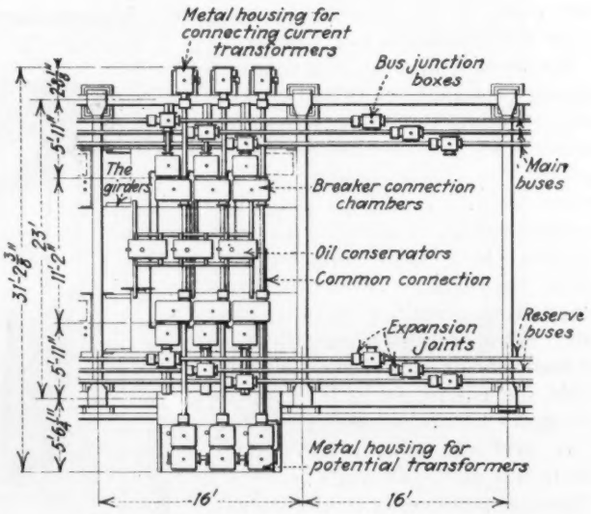
a secondary function. Another precaution taken to avoid stresses from contraction and expansion is the use of flexible connectors between bus sections and between the buses and apparatus with which they are connected. Live parts which are not covered with insulation at the factory are taped after insulation in the field.

Disconnecting switches have been eliminated in this installation. The oil circuit breakers are disconnected from their circuits by lowering them bodily with a traveling motor-operated elevator. The circuit breaker may be dropped to supports at the "disconnected" position, where its mechanism may be tested or its tanks lowered to permit inspection of the contacts, or it may be lowered to the "transport" position and rolled into a repair house at one end of the structure. If desired, another breaker may be substituted for the one removed. As the circuit-breaker bushings leave the inclosing shells which support the stationary contacts the openings are automatically closed by shutters which seal off the live contacts. The breakers are held in the "connected" position by six cams mounted on the girders of the breaker housing which engage lugs on the breaker unit. The cams are moved by a hand wheel through a large worm gear-and-screw mechanism powerful enough to lift the breaker.

Three simple rugged interlocks prevent (1) releasing the breaker clamping device unless the elevator is in its proper position; (2) dropping a breaker unless the breaker is open; (3) operation of the clamping device with the breaker disconnected. Interference members



33,000-volt connections of outdoor metal-clad substation

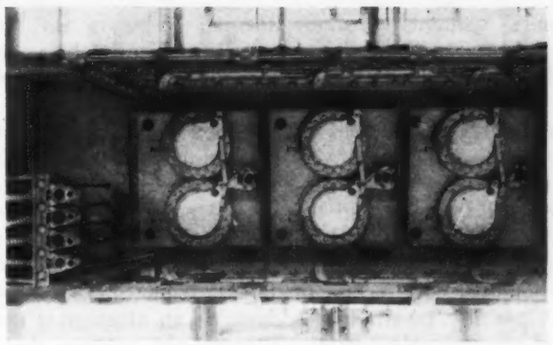


prevent unbolting the tanks unless the breaker is in the disconnected position.

The circuit breakers used are rated at 1,000,000 kva. and 37,000 volts. They are made up of single-pole units bolted together with a motor mechanism and control-circuit connectors mounted on one end. Explosion chambers are used on the stationary contacts. A brace running between the explosion chambers serves as a guide for the vertical operating rod.

Connections are made with the main and reserve bus junction boxes at three levels—the buses entering at the upper or lower level and connections at the intermediate level. This arrangement allows any section of bus to be removed without disturbing the other sections, since the buses can be installed alternately on the upper and lower levels.

Through-type current transformers with the cable entrance below and the connection entrance at the top of the back are used. The potential transformers are equipped with housings and disconnecting contacts similar to the oil circuit breakers. The entire transformer can be lowered to the disconnected position when any work is to be done on it or the fuse is to be changed. Shutters automatically close the openings in the bottom of the shells housing the stationary contacts, just as the



Looking up into circuit breaker housing

The six shutters cover the stationary terminals into which breaker terminals fit when circuit is closed. At the left are the disconnecting devices for the control circuit.

disconnecting contacts on the transformer bushings leave the openings. The potential transformers can be left in the disconnected position and the tank removed or the entire transformer can be lowered. A separate traveling elevator is provided for handling the potential transformers and their inclosing tanks.

Power for operating the oil circuit breaker elevators is obtained from connection boxes mounted on the pillars of the station structure under each bay. Each connection box circuit is interlocked with the control source for that particular bay so that power is not available for operating the elevator when the corresponding breaker is closed. The control cable is not long enough to reach to a connection box in an adjacent bay. The elevator is motor-operated from a push-button control station. A limit switch prevents overtravel in either the up or down direction. When the platform reaches the proper height a plunger enters the interlock box and unlocks the breaker clamping mechanism.

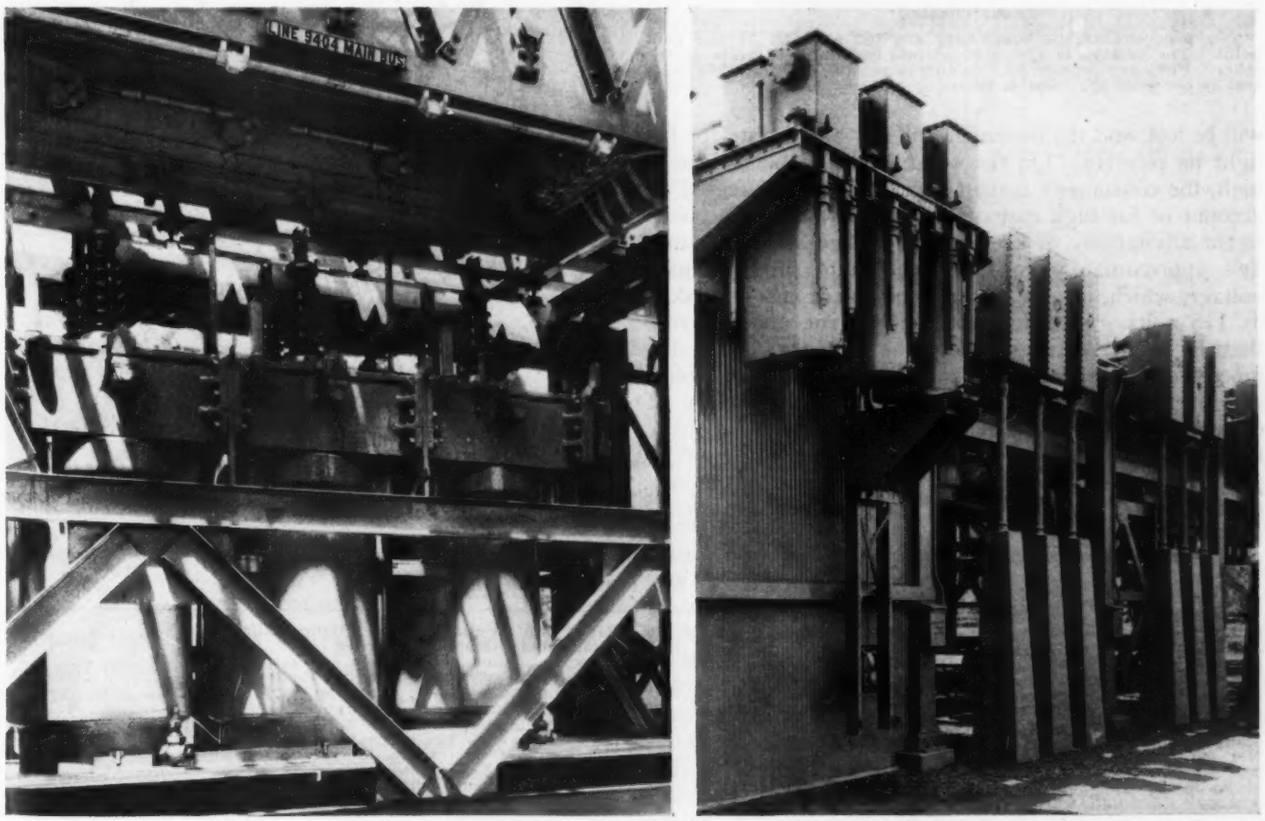
This equipment was designed to give protection to operators and to men engaged in maintenance work on high-voltage circuits. Since every current-carrying part and also the insulators are totally inclosed by metal, fire or soot originating near the equipment cannot affect or damage them, neither can they cause the secondary breakdowns which may occur in the open type switching equipment. Such breakdowns are often more severe and cause more damage than the original fault.

Undervoltage Alarm

THE use of relay-operated alarms to notify substation operators of undervoltage is not by any means a new idea. Alarms of this type are used by various electric companies in small town offices so that the office manager may act also as operator. In the latter case the instruments are often hung on the wall and the wiring from the relay to the alarm bell, if not permanent, is an eyesore to customers and the office force alike. J. O. Develin and J. W. Stephens of the relay department of the Tennessee Electric Power Company conceived the idea of mounting the alarm systems on individual panels, thereby making it possible to connect them to any convenience outlet in the office.

The panels used are of 1½-in. mahogany stained oak, 12 in. wide and 16 in. long. They are mounted on standards made of 2-in. boards, 4 in. wide and 12 in. long.

On the front of the panel are mounted the relay, the



Circuit breaker on elevator ready to be raised into housing and one side of switchgear structure

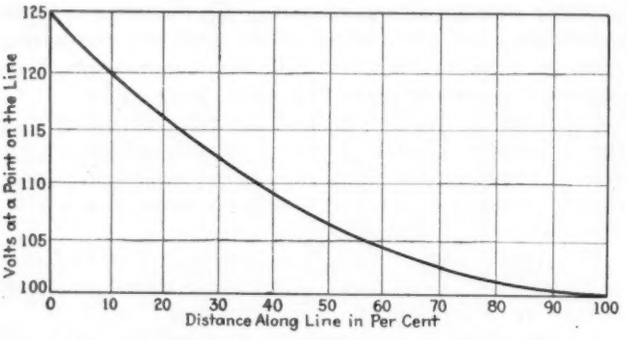
Auxiliary transformers connected with reserve bus are shown in foreground on side of inclosed inspection bay; 33-kv. cable risers with current transformer housings above extend along remainder of this side.

alarm bell and a tumbler switch to disconnect the bell. On the back is a box for the three dry cells that operate the bell. If the voltage falls below normal the relay closes the bell circuit. The relay is of the Westinghouse CV type, which is especially adapted to this use in that it can be set over a wide range of voltage.

Consumers' Voltages Along a Secondary

By Merrill DeMerit
Assistant to President West Penn Power Company

WITHIN reasonable limits, the consumption of an incandescent lamp varies approximately as the square of the voltage impressed upon it. The illumination decreases much more rapidly than the voltage, also the life decreases rapidly as the voltage increases. These facts indicate that if voltage is low at a lighting consumer's point of service, consumption and consequently revenue



Voltage along secondary line when load is evenly distributed

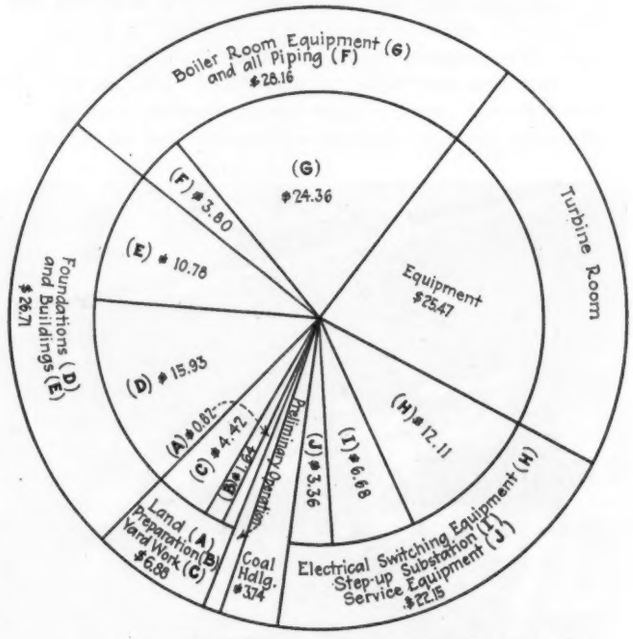
Ten per cent of the consumers are fed at each 10 per cent point. The voltage is 125 volts at one end and 100 volts at the other. Fifty per cent of the consumers receive less than 105 volts and 20 per cent 115 volts or better.

will be lost, and the consumer will pay a high rate for the light he receives. On the other hand, if the voltage is high, the consumer's cost of service will be increased on account of his high cost of lamp renewals. This points to the advisability of keeping the voltage at the consumer's approximately equal to a definite predetermined voltage, which, in a very large number of cases, is taken as 115 volts. Knowing that this is true and realizing that the voltage decreases along the secondary as the distance from the transformer increases, it is usually necessary in revamping to estimate the average voltage at consumers. Quite frequently, the assumption is made that with high voltage at the transformer, say 5 or 10 per cent, and with low voltage at the end of the secondary, say 5 or 10 per cent, the average of the consumers' voltages is about normal. This is far from the case. The illustration shows graphically the voltage along a secondary line. Conditions given are extreme but not beyond those occasionally found in practice. In this figure, it is assumed that the load is evenly distributed along the secondary. With the ordinary assumption, the average voltage would be 112½. Actually, it is 107.47. The assumption would be that 50 per cent of the consumers are getting 112 volts or higher. Actually, only 20 per cent of the consumers receive more than 112 volts, while 50 per cent receive below 105 volts.

When any revamping is done, if an attempt is made to check the calculations of increased revenue due to revamping against the measured increase in consumption due to the increased voltage, it will be necessary to take this fact into consideration.

Unit Costs and Performance of Toronto Station

DATA on the equipment and performance of the Toronto station of the Ohio River Edison Company have recently been made available in booklet form by the designers and constructors, Stevens & Wood, Inc., New York City. The accompanying graph and figures are based on data reported by that company.



How the $113.85 per kilowatt is distributed

Based on a total cost of $15,939,019 for four units totaling 140,000 kw.; includes all fixed charges.

Operating Data of the Toronto Station for 1927

Kilowatt-hours generated (net)	425,148,440
Station use of power (per cent)	6.53
Maximum hour load (kw.)	91,400
Annual load factor (per cent)	56.8
Maximum monthly load factor (per cent)	77.4
Annual capacity factor based on 70,000 kw. installed (per cent)	72.0
Range of daily load factor for week days (per cent)	80 to 93
Net B.t.u. per kilowatt-hour	16,196
Net station thermal efficiency (per cent)	21.1
Make-up to boilers (per cent)	1.85
Average main-unit water rate (lb. per kw.-hr.)	9.95
Net station water rate (lb. per kw.-hr.)	12.65
Average steam pressure at turbine (lb.)	352
Average steam temperature at turbine (deg.)	673
Average condenser absolute pressure (in.)	1.17
Inlet condensing water temperature (deg.)	57
Maximum circulating water temperature (deg.)	81
Boiler feed temperature (deg.)	360
Average boiler rating (per cent)	261
Average hourly generation per boiler (lb.)	192,000
B.t.u. added at boiler per pound of steam	1021
Average temperature air to preheaters (deg.)	98
Average temperature air from preheaters (deg.)	311
Pounds coal per net kilowatt-hour	1.32
Average Coal Analysis:	
Moisture (per cent)	5.26
Volatile (per cent)	39.19
Carbon (per cent)	49.55
Ash (per cent)	11.26
Sulphur (per cent)	3.46
B.t.u. as received	12,305
Approximate fusion temperature of ash (deg.)	1,950

Common-Neutral Network*

Advantages found are improved economy, better voltage regulation and less service interruptions. No serious telephone interference has been experienced

By M. T. Crawford

Superintendent Distribution Puget Sound Power & Light Company, Stone & Webster, Managers, Seattle, Wash.

FOR overhead distribution in fairly well built up residential sections the Puget Sound Power & Light Company has been using a 4-kv. common neutral system, with a networked grid on both primary and secondary mains, in certain sections of the system for the past five years. Advantages over the ordinary radial form found in the experience so far are improved economy, better voltage regulation and greater continuity of service.

In the usual residential areas it has been the practice to construct distribution lines in alleys wherever possible. About every two blocks on the cross-streets which intersect the alleys cross-leads are built intersecting all the main leads in the alleys, forming a grid network with a mesh of about one by two blocks. Four wires are strung in on these leads of uniform No. 4, B. & S. size, weatherproof copper and tied in at the intersections to form four similar grid networks over the entire area served.

One grid forms the single-phase primary circuit with 2,400 volts to the grounded neutral of a 4,157/2,400-volt star, three-phase, four-wire system. Another is the grounded common primary and secondary neutral which, with the remaining two grids, forms the 240/120-volt Edison three-wire service mains.

Transformers of suitable size are hung as needed. One primary lead is connected through a fused cutout to the one-wire primary grid. The other lead, together with the middle lead of the secondary winding, is connected to the common neutral wire.

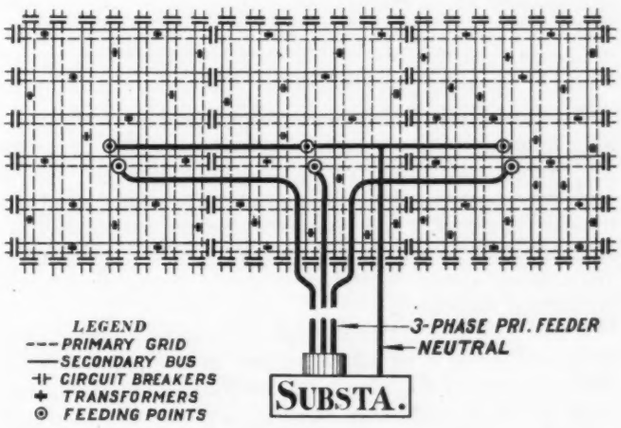
Feeders from substations tap into this primary grid as frequently as load density requires. Primary and secondary grids are sectionalized with porcelain breakers at the boundary lines between the areas supplied by adjoining feeders. Primary feeders are strung out as three-phase, four-wire, No. 4/0 copper feeders, branching off at the outer end as single-phase, two-wire feeders to the respective grid feeding points. Accompanying is a circuit diagram of the system.

Advantages of System

Among the economies effected is a substantial saving in copper resulting from the use of a common neutral for primary and secondary, requiring four wires instead of five in the networked area. Copper economy also results from the three-phase star system and the networking of mains. Moreover, a reduction in pole space is effected by the use of one-wire primary circuits.

Networking into a mesh or grid of both primary and secondary mains requires less copper to maintain satisfactory voltage regulation, as it makes maximum use of the diversity between various services and provides for ready flow of power along the mains. Economy in operation results from the reduction in transformer burnouts.

It has been found possible to maintain voltage regulation, ranging ordinarily within 2 per cent above or below the 120 volts normal at consumers' service switches. This is done by careful adjustment of the feeder regulators to compensate for all voltage drop in the primary feeder, the distribution transformers and the service drops, these items varying in proportion to the load. Voltage drop which cannot thus be compensated for is that in the primary grid between the feeding point and the transformers, plus the drop in the secondary grid from the transformers to service poles. These factors vary with the distance from the feeding point and their sum is kept within a maximum range of 5 volts. The use of networks greatly facilitates this accomplishment.



Common primary and secondary neutral used in Puget Sound network

Occasionally one or more transformer primary fuses will be blown by trouble, and this results in immediate receipt of low voltage complaints. Where a transformer burns out it is cleared on the primary side by the fuse and nearly always burns open on the secondary side. If the secondary does not clear, it acts in the same way as a secondary short circuit which blows fuses on nearest adjoining transformers and produces very low voltage in the immediate vicinity.

So long as the size of the mains is kept uniform at

*Based on paper presented before Northwest Electric Light & Power Association.

No. 4 wire and the load density averages about 25 kw. diversified feeder demand per block, a short circuit at one point on the mains will not produce "cascading" or the successive blowing of fuses on all other transformers connected to the same mains.

One of the most promising features in connection with the networking of the primary wires into grid form is found in the unusual ability to burn clear of short circuits without interrupting service. A large portion of the Seattle distribution is constructed on joint poles with wires of another utility above the primary arm of this system. During stormy weather service wires leading from the secondary mains of the other utility to consumers' premises frequently come loose and fall across the primary grid, and in a large percentage of cases these burn clear without opening the feeder circuit breaker. Short circuits also occur from time to time from other causes.

A tabulation of short circuits during 1927 on a section of this system, including 621 circuit-miles in a total of 72 circuits, shows there were 158 primary short circuits of all kinds. In 152 cases the trouble was burned clear, usually without more than one or two openings and reclosings of the station breaker. In the remaining six cases the breakers locked out after three operations until the trouble was cleared. The average outage in these six cases was only 28 minutes, as with the network system one trouble man can cut all wires clear in a faulty span and resume all service at once.

Telephone Interference Constitutes One Objection

One of the objections expressed to the use of the common neutral is that it results in serious interference to the circuits and service of the telephone company whose lines are constructed in close proximity. This has been the case principally in locations where the telephone construction was not of the best in every detail or where the distribution system was not properly designed for coordination therewith.

It has been found that a great deal can be accomplished by planning the distribution system in co-operation with the engineers of the telephone company. This was done from the start and there have been practically no cases of interference with telephone service in Seattle. A few minor disturbances have been brought to attention, but these were immediately and easily remedied by slight rearrangement of circuit positions. Although the telephone engineers report a slight increase in noise units on their circuits, this increase is not sufficient in amount to impair telephone service.

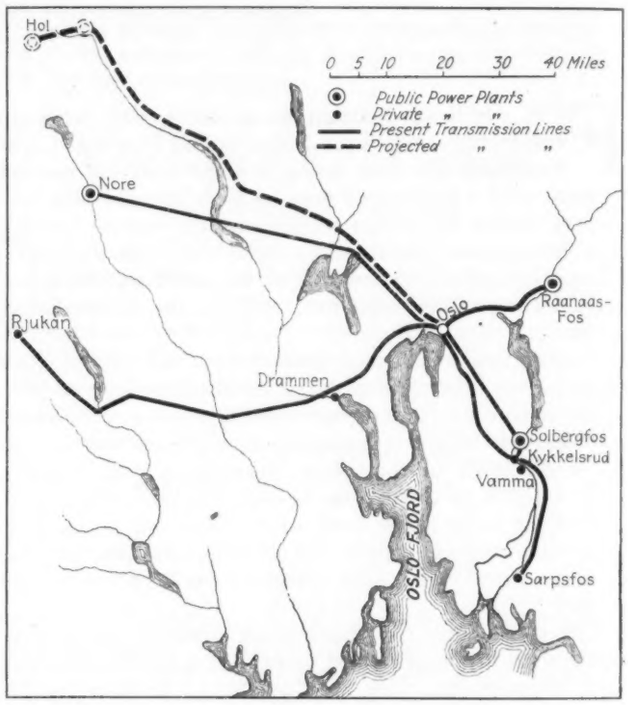
Adequate ground and neutral capacity have helped minimize telephone interference and also trouble from high-voltage hazards. It is the uniform practice to install adequate grounds at the base of transformer poles, consisting of either ground cones buried in coke or driven pipe grounds. Ground connection to water pipes is not made, although the proposed new city wiring code carries a provision requiring this at consumers' switches. The grid system provides two paths from each transformer neutral connection independent of its immediate ground. The stringing in of heavy neutral feeder capacity from feeding points on the grid back to the substation where it is permanently grounded, without any ground connections en route, and the grouping of single-phase leads into three-phase feeders alongside the neutral feeder wire assist considerably in maintaining conditions of safety and freedom from telephone interference.

High-Head Plant for Norway

By J. B. Naumann
Oslo, Norway

THE Norwegian state owns one hydro-electric plant, Glomfjord, situated in the northern part of the country, and is part owner of another, Solbergfos, in the southern part. A third plant, Nore, is under construction and the first unit will be put in operation within a short time.

The Nore power plant is situated in the southern part of the country on the river Numedalslaagen, about 70



Power supply for Oslo, Norway

miles from Oslo. The total head available is 1,500 ft., which is going to be divided between two plants having heads of 1,150 ft. and 350 ft. respectively. The first of these plants is now being constructed. The storage dam is of the gravity type, designed for a maximum variation in water level of 60 ft. It is 120 ft. high at the deepest point, 900 ft. long and has a storage capacity of about 300 acre-feet.

The pressure tunnel, which is driven through solid rock, is 3¼ miles long and has a cross-sectional area of 430 sq.ft. It conducts the water from the storage reservoir to two distributing chambers, from which eight pipe lines, each 3,300 ft. long, lead to the power house.

The power house is designed for eight units with a capacity of 36,600 hp. each, making a total of about 290,000 hp. The initial installation comprises four units. Impulse wheels with double runners, 10 ft. diameter, are used and operate at 300 r.p.m. Two of the turbines were made in Norway and the other two in Germany. Energy is generated at 12,000 volts and is stepped up to 132,000 volts directly outside the power house.

The output of this initial installation will be 450,000,000 kw.-hr., which, assuming 6,000 hours of operation per annum, corresponds to an average load of 75,000 kw. Part of this power will be transmitted to Oslo over a line 73 miles long.

Interconnection Load Control*

Difficulties with energy flow in closed transmission ring led to special operating equipment and indicating devices on Texas system

By H. E. McDowell
Texas Power & Light Company

THE controlling of energy flow over transmission circuits so as to fulfill contracts as to the amount of load to be exchanged at each given point is an important phase of interconnection engineering. Power distributes itself over parallel circuits or transmission networks in proportion to the relative circuit impedance, but the distribution is complicated by the existence of generating stations within a given district. If purely a relative impedance is encountered, flow can be controlled by means of adjusting taps on step-down or auto-transformer banks. This has brought into popular use the auto-transformers arranged for tap changing under load.

As an example of the controlled flow of power under more involved circumstances the conditions indicated in Fig. 1 may be considered. In this instance the contract provided for furnishing the power required west of *L* and south of *M*, the two interconnection points, in excess of the capacity of generating station *A*. The transmission system between *A* and *M* was a long, low-voltage line, and the voltage conditions at *M* were so poor as to demand a second feed or other means of reinforcing the transmission system. The two systems were first joined at *L* and the power was fed westward, relaying some of the capacity at *A*, which was diverted northward toward *M*. In view of the fact that *M* constituted a low point on the system, it seemed obvious that the generating station at *W* would furnish power in the direction of *M* also and improve the regulation.

Unfortunately, this was not the case, and what actually

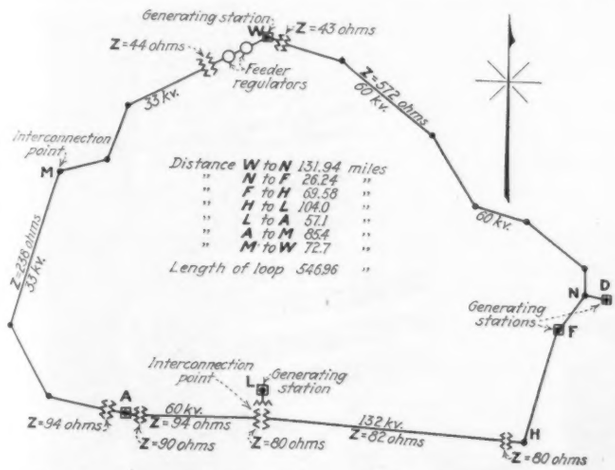


Fig. 1—Transmission ring requiring energy control

took place was a circulation of power in clockwise direction around the loop in spite of the extremely small relative capacity of the transmission circuits between *A* and *W*. The problem was, of course, one of relative impedance, but it was not feasible to change the impedance relations materially for the reason that there were a number of towns between *A* and *W*, and it was not possible to arrange for proper regulation at *M* and various other towns in the territory under the various operating conditions, such as having the line open at *A* or *W* without the installation of expensive condenser equipment, which the load in the territory would not justify.

The situation was so serious that the loop was opened just north of *M* and so operated, thereby losing the real advantage which was sought in constructing the *MW* circuit. In view of the fact that the purchasing company had a relatively small generating station at *A* and could

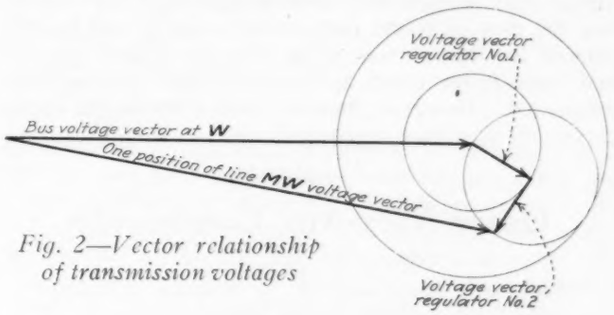

Voltage vector regulator No.1
Bus voltage vector at W
One position of line MW voltage vector
Voltage vector regulator No.2

Fig. 2—Vector relationship of transmission voltages

not be considered responsible for these conditions, it was necessary for the other company to provide corrective apparatus. This was accomplished by installing two three-phase feeder regulators in series in the primary side of the step-up transformer bank at *W*. The two regulators connected in series act as boosters and permit of regulating the voltage, by adjusting the relative impedance of the transmission circuits and varying the phase angle between generating stations *A* and *W*, without the need of governor adjustments. The vector relationship between the bus voltage at *W* and the voltage of the *MW* transmission circuit is indicated in the second figure.

The arrangement adopted is flexible, allowing the control of power flow both through variation of the phase angle between the respective voltages and controlling the wattless flow and also, through voltage regulation, permitting the adjustment of the magnitude of the transmission circuit voltage with respect to the bus voltage at *W*. The apparatus has worked out in practice as anticipated, but due to the fact that the operation of these regulators requires considerable technical knowledge in order to obtain proper results it has been necessary to offer special instruction to the operators and to provide them with a graphic record of actual conditions at any moment.

Two electrically operated Selsyn indicators were provided which are so geared and connected as to indicate at all times the relation of regulator positions to each other, and also with respect to the generating station bus. The equipment not only provides a visual indication of the phase relations between the voltage vectors but also indicates their relative magnitude. Indicating ammeters, wattmeters and reactive volt-ampere indicators are provided as well as a phase-angle indicator which shows the true relation at all times of the current to the voltage. In spite of the expense, it is likely that this type of apparatus will be used to a considerable extent as the number of interconnections increase and the problems become more formidable. Compared with any other class of apparatus found useful for this purpose this equipment justifies its consideration.

Considerable economy can be effected where there is a large-capacity auto-transformer bank having a tertiary

**Abstract of an address by Mr. McDowell at the eighth annual convention of the Southwestern Geographic Division, National Electric Light Association, at Biloxi, Miss.*

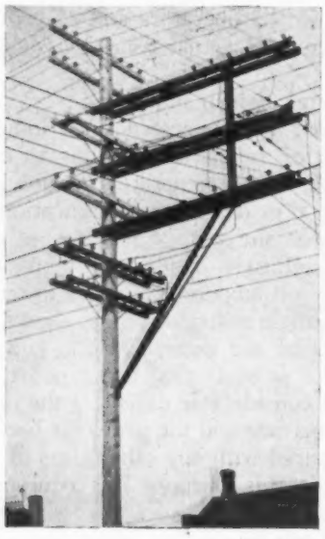
winding available for providing power supply to the primaries of the induction regulators. This will, in fact, save investment in the high-voltage transformers of capacity equivalent to the capacity of the regulators. Sometimes a modification of this scheme is used to save regulator capacity, thus making use of tap-changing booster transformers, the regulators constituting merely an accessory to provide straight line transition in the voltage steps. This arrangement does not have the advantage of varying the phase angle between voltages on either side of the booster transformers. It is, therefore, less useful for the control of power flow. Synchronous motors may be used with considerable effect for controlling the flow of power, but should probably not be considered for that purpose alone because of their expense and their lesser effect as compared with the methods mentioned. However, they are useful for power-factor correction or voltage regulation.

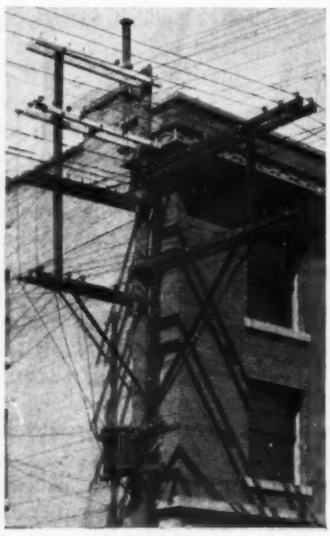
Heavy Alley-Arm Construction

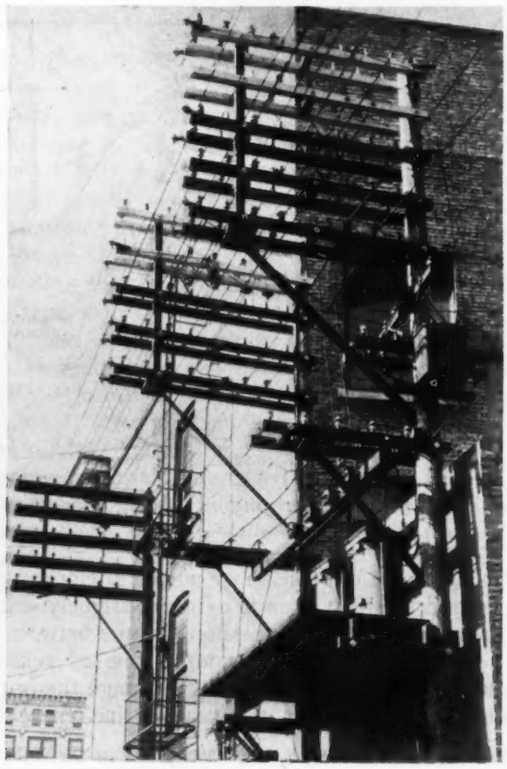
By T. A. Robinson
Distribution Department, City of Winnipeg (Canada) Hydro-Electric System

DUE to the scattered nature of the metropolitan district of the city of Winnipeg it is not economical to use underground distribution throughout. This and the fact that two utilities, one privately owned and the other municipal, are in direct competition result in very heavy overhead leads through the downtown alleys. A joint use agreement is in effect, by which the two utilities may divide the pin space vertically, one utility taking the property side and the other the street side of the pole, or alternate arms may be taken.

Practically all the buildings in the downtown district are flush with the alley property line. This practice makes necessary the use of side-arm construction. The accompanying illustrations are interesting as showing the weight of lead and the manner in which transformer installations are made on platforms projecting into the lane. In order that workmen of either organization may positively identify higher voltage conductors all primaries are carried on separate arms which are painted white. The primary neutral conductor is always installed on the property side, white insulators being used.







Heavy side-arm leads characterize the downtown section of Winnipeg

Convenient Form for Power Exchange by Two Systems

TO FACILITATE records of power interchange between the Central Maine Power Company and the Cumberland County Power & Light Company, Portland, Me., the form reproduced herewith is employed. The load dispatcher of each company has a duplicate set of forms numbered serially and 4⅜x6 in. in size. Each

CENTRAL MAINE POWER CO.—INTERCONNECTION—CUMBERLAND COUNTY PWR. & LT. CO.

REQUEST FOR EXCHANGE OF POWER No. 1175

ORIGINAL—LOAD DISPATCHER, C. M. P. CO.

Originated at Sewall St. Sub-Sta. [X] Date April 15, 1928.
" " Augusta Sub-Station [ ] Time 11:11 P.M.
Name of Originator C. F. B. Sawyer.

Offers: To Give [ ] To Take [X]	REMARKS
K. W. 2000	
Start 6:30 A.M. April 16th 1928	
Stop 5:30 P.M. Inclusive	
Name of Receiver Perry.	
Offer Accepted [X] Time 11:11 P.M.	
" Refused [ ] "	
Name of Man Replying Perry.	
" " " Receiving Sawyer.	

Simple form covers wide range of information in power exchange

blank carries space for noting the origin of the request to give or take energy, the date, time of starting and stopping the transfer, kilowatts involved in interchange, name of dispatcher or other employee representing each company in the transaction and the action taken upon the request or offer. Copies of these in carbon are transmitted daily to the operating engineer or superintendent. The completeness of the form and simplicity of make-up are marked advantages.

The Power Salesman

An industrial engineer of several years' experience outlines for men who have just entered power sales work what he considers the major requirements, emphasizing the salesman's attitude toward his company and customers

By B. J. GEORGE

Industrial Engineer Kansas City Power & Light Company, Kansas City, Mo.

TO MANY young engineers entering the power sales department of an electric utility there comes no idea, or only a hazy one, of the nature of his responsibilities and opportunities. This uncertainty and lack of knowledge on the part of the novice result in a corresponding loss of efficiency for a considerable period. He finds himself apparently upon shifting sands with no general comprehension of his place in the scheme of his company's organization.

It is well, therefore, to set down the essential qualifications of a power salesman. They are, in brief, all of the requirements of a successful salesman plus the education and experience of an engineer. The undergraduate who inclines toward the commercial side of engineering has at least three important objects to attain during his college career: (1) The attainment of a thorough technical knowledge of engineering, including sound instructions and practice in economics, accounting, English, composition, and public speaking; (2) a reasonable amount of practical work in actual engineering fields, preferably secured during summer vacations; (3) a general understanding of the commercial work of a public utility and a realization of the position of importance and responsibility which he must occupy if he succeeds in his work. Knowledge of economics and accounting is essential in reaching a logical conclusion concerning the problems under consideration. Practical training guides the engineer in selecting essential data to be applied to the problem and leads to the adaptation of the theoretical values to the needs of the practical problem. A knowledge of English, written and spoken, enables the salesman to place his conclusions before other parties in a clean, concise and convincing manner, conducive to the instilling of confidence. These factors, combined with an innate faith in himself, his company and its ideals, will go a long way toward insuring success in his chosen field. Summing up, the ideal power salesman must possess a technical education, practical training, a pleasing personal appearance, a good address, honesty and integrity of character, tact, courtesy, respect for superiors, a viewpoint of the industry, faith in himself, his company and its products and ideals, and, above all, the ability to judge men.

Consider the effect upon the customer when approached by a salesman unshaven, unkempt and of poor appearance. What does a technical training avail if the salesman lacks a knowledge of written and spoken English? How ineffective becomes a poorly written report or an illogical, broken and mumbled oral report to a manager or to a board of directors that is considering the use of electric energy purchased from the central station! The ability to think and talk simultaneously is a most valuable asset in any profession. What is to be gained if, after having presented the problem in a logical, clear and concise manner, the salesman, through ignorance of the psychology of salesmanship—the knowledge of men—bungles the job by ill-considerate words or action? Persistency is an attribute of salesmanship to be consistently practiced, yet the knowledge of when to cease being persistent is none the less important, else, like the collection of Mark Twain's minister, the sale will be lost through too many words. And, finally, what profits the company if it secures the new business and afterward loses the confidence and perhaps the patronage of that same customer through the realization that the salesman has misrepresented or perhaps been overzealous in his desire to make a sale and secure a coveted contract?

Business enterprises, like individuals, are marked by the standard of character and integrity which they exhibit to those with whom they deal. Unlike individuals, however, most modern business enterprises must act through agents who are ambassadors to the court of public opinion. The public utility corporation acts through its agents, and the industrial engineer is one of the most important of these. Let the salesman bear in mind that the alleged facts which he utters, the promises which he makes and the courtesies and discourtesies which he shows toward a customer are, in so far as the public cares or knows, coming directly from the company which he represents. The fact that the modern public utility has long since ceased to use the motto "Let the public be damned" is due largely to the fact that its agents who are constantly coming in contact with the public have come to realize the importance of a fair, courteous and straightforward attitude toward those with whom they deal. Their action has softened public opinion toward the utilities.

DUTIES OF THE SALES ENGINEER

One of the first duties of the power salesman is that of obtaining new customers for the utility. A certain amount of preliminary work is necessary prior to the immediate negotiations for new business. With a prospect at hand, the engineer must begin his real task. He must make personal calls upon the representatives of the prospective industry or, if they be inaccessible in person, they should be reached by correspondence. With such data as can be had relative to the requirements of the customer, the salesman must now gather many technical data from the various departments of his company, including the location of existing lines, cost of line extensions and transforming equipment and the financial responsibility of the prospective customer. He must also proceed to analyze the business of the customer from the

standpoint of his need for electric energy. Demands and consumptions must be estimated and the cost of purchased power arrived at. The cost of power must be compared with costs from other sources available to the customer. In many cases the operating records of the existing oil-engine or steam-driven plants will not be disclosed to him. It then becomes necessary to set up a probable operating cost report based upon information from similar cases where the operating records are available. In other cases such operating statements are given by the customer. These must be analyzed and scrutinized to determine omissions and errors, either unintentional or otherwise. Where no source of power is yet installed, estimates must be made covering the various methods of supplying power.

Having made the detailed survey of the plant, its products, its production schedule, its electric or steam requirements and its peculiarities which differentiate it from the other plants of its general class, the industrial engineer will then have assembled vital information as follows for each form of power being considered: Investments; fixed charges; operating expenses; comparative costs; advantages and disadvantages in operation.

In the case of customers whose product is such as to require the use of large amounts of exhaust or low-pressure steam, it often becomes necessary to go into elaborate details. Quite frequently it becomes necessary to prepare several sets of data based upon suggested changes in the production schedule of the plant. These changes, however, must not be such as are impractical from an operating standpoint or such as incur intangible expense that is greater than the saving in the cost of power.

The mass of detail thus assembled, analyzed and carefully checked must usually be assembled in a written report, the extent and contents of which are dependent upon the needs of the customer. The report should be in logical form so arranged that the meat of the report—the important facts and conclusions—stands out at the front, easily available and quickly grasped by the busy executive, leaving to the body of the report the detailed figures substantiating the proposed facts and conclusions. The contents of the report should be such as are pertinent to the problem, unincumbered with superfluous detail, unneeded words or flowery language; clear, concise, and logically arranged; tabulations with explanatory notes to enable the non-technical manager to grasp their import; neat and typographically pleasing to the eye. Technical matter explanatory to the tables and supplementary details of interest to those who are to go minutely into the engineering phases of the report are best placed in an appendix. A report thus submitted may be judged by these standards:

1. Does it reflect a methodical, neat, thorough, honest and accurate character of a perfect salesman—for it is a salesman in effect?

2. Will it truthfully answer these questions:

(*a*) What is the general plan proposed?
(*b*) What is the basic source of these data?
(*c*) What investment must I make to avail myself of this service?
(*d*) What will be my annual operating cost for this service?
(*e*) How much money per annum will it save me?
(*f*) What are your rate forms and contract conditions?
(*g*) What advantages other than immediate financial saving will it afford me?

3. Will it stand the acid test of analysis and criticism by the customer's engineers and accountants or by the oil-engine and steam-engine salesmen?

Contracts covering electric service should always be submitted at the time of submitting the report in order that the conclusion of the negotiations may be had at the propitious moment.

Up to this time the technical or practical engineering side of the salesman's knowledge has been of greatest importance, but having prepared the report, his salesmanship must now be brought to the front. He must sell himself, his company and its products. It is insufficient that he sell the product. He must sell himself, for it is with the salesman that the customer is dealing, and human personal prejudices and indifferences are strong and often the failure of the salesman to sell himself bars him from selling his company and its product. Having sold himself, he must impress the customer with the idea that his company is thoroughly able and willing and actually engaged in rendering modern electric service 365 days in the year for 24 hours per day.

The first and most important business of the public utility is the sale of its product, electric energy. At no time must the zeal of the salesman to make a sale of equipment be allowed to prejudice the chances of securing the real business of the customer. With the contract for energy assured, contracts for the purchase of motors, transformers, switches and other equipment may be presented to the customer and negotiations completed. The full facilities of the company in advising as to the proper equipment should be available to the customer and bids submitted by the salesman should be for first-class, tried and proved equipment. The sale of inferior equipment must under no circumstances be allowed to hazard the rendering of satisfactory service to the customer. Repair bills and replacements for inferior equipment will prove a poor source of revenue in the long run.

In securing new business, there is one thing that should be taken into consideration that is sometimes overlooked. This is the financial responsibility and the permanence of the customer to be served. In his zeal for securing new business for his company and his failure to investigate the financial responsibility and the dependability of the customer the salesman often wastes time and lets a better class of business pass him by, resulting in adding a new customer who soon falls by the wayside, leaving

Essential Qualifications of a Successful Power Salesman

A technical knowledge of engineering, including the theory and practice of economics and accounting.

A practical knowledge derived from engineering experience.

A general understanding of the commercial work of a public utility.

A realization of the importance and relation to the utility of a successful power salesman.

Ability as a salesman.

the utility with large investments and little or no revenue to meet the fixed charges and operating expenses incurred in the investment.

A second duty is that of assisting in retaining old business. The degree to which old customers are retained and their additional wants supplied is the chief criterion of the success of any business. The alert commercial department of a utility will see that its customers are not neglected. They should be called upon from time to time and be made to realize that the utility has an interest in their welfare. Their products and their production schedules must be constantly studied to enable the salesman to suggest more economical uses of his company's service. He must keep himself informed about the demands, consumptions and cost of power to his customers. In this way he is enabled to act as a competent rate and power consultant. He must always stand ready to iron out the little errors and misunderstandings that come up from time to time. By thus being constantly in contact with his customers, he is assured that his company will not only retain its present business but will receive the natural increase in business that comes from satisfied customers. The salesman who is asleep on the job, cocksure in the belief that a customer once obtained is a customer forever and to be forgotten, awakes soon to find that an oil-engine or steam-engine salesman has robbed his company of what might have been a source of revenue and profit.

Protecting Lines from Lightning Disturbances

SPEAKING before A.I.E.E. members at New Haven, Conn., recently, W. W. Lewis of the General Electric Company said:

It is possible to increase the safety of transmission lines and apparatus from lightning disturbances by adhering to the following principles:

(a) Construct the transmission line so that the conductors are as near to the ground as the necessary clearances will permit, and preferably build the line with the conductors horizontally arranged.

(b) Install one or two overhead ground wires in accordance with the design of the tower and the requirements for reduction in potential imposed by the height of the conductors.

(c) Use sufficient insulation on the line to prevent flashover with the maximum potential gradient that may be obtained with the number of ground wires used.

(d) Maintain recommended insulation for one-half mile or so from the station in order to protect station apparatus. Over this section additional ground wires extending to the station may be used in order to place this section on a par with the over-insulated section as far as flashovers are concerned.

(e) Install lightning arresters immediately adjacent to the transformers so as to prevent reflection and hold down the potential to a comparatively low value.

Some of the data from his paper* are presented in the accompanying tables for the value that they may have in insulating lines and installing ground wires.

*Address entitled "Relation Between Transmission-Line and Transformer Insulation."

VERTICAL ARRANGEMENT OF CONDUCTORS

Potential Induced and Insulation Necessary to Prevent Flashover

Conductor	Conductor Height, Ft.	Potential Without Ground Wires 100 Kv. per Ft.	Potential With Two Ground Wires 100 Kv. per Ft.	No. of Insulator Disks Required to Prevent Flashover	Impulse Flashover, Kv.
Top.....	75	7500	2480	19	2500
Middle.....	60	6000	2340	18	2380
Bottom.....	45	4500	2160	16	2140

RECOMMENDED LINE INSULATION

System Voltage Kv.	Recommended 60-Cycle Arc-Over of Line Insulators, Kv. Effective	Corresponding Number of 10-In. Disks Spaced 5¾ Inches
66	250	4
88	360	6
110	400	7
132	450	8
154	550	10
187	650	12
220	750	14

HEIGHT OF ACTUAL LINES AND INSULATION REQUIRED TO PREVENT FLASHOVER

System Voltage	Average Height of Lowest Conductor at Tower Feet	Possible Lightning Potential 100 Kv. per Ft.	Potential With Two Ground Wires, Conductors Horizontally Aranged	No. of Ins. Disks Required to Prevent Flashover	Flashover of Insulator Disks, Kv.
66	35	3500	1290	9	1280
88	39	3900	1440	10	1410
110	47	4700	1740	13	1780
132	47	4700	1740	13	1780
154	50	5000	1850	14	1900
187	50	5000	1850	14	1900
220	56	5600	2070	16	2140

INSULATION OF ACTUAL LINES

System Voltage, Kv.	Crest Value Line to Neut. Voltage, Kv.	No. of Insulator Disks		Impulse Flashover Kv.	Ratio Impulse to Normal Voltage
		Range	Weighted Average		
66	54	4–6	5	750	13.9
88	72	5–7	6	890	12.4
110	90	6–9	7	1020	11.3
132	108	9–12	10	1410	13.1
154	126	10–12	10	1410	11.2
187	153	10–12	10	1410	9.2
220	180	12–16	13	1780	9.9

FLASHOVER OF INSULATOR STRINGS

Based on 10-In. Disks Spaced 5¾ Inches

No. Disks	Length of String, Inches	60-Cycle Arc-Over Kv. Effective	Impulse Arc-Over Kv. Max.
3	17.3	200	470
4	23.	250	610
5	28.7	300	750
6	34.5	360	890
7	40.2	400	1,020
8	46.	450	1,150
9	51.7	500	1,280
10	57.5	550	1,410
11	63.2	600	1,520
12	69.	650	1,660
13	74.7	700	1,780
14	80.5	750	1,900
15	86.3	800	2,020
16	92.	850	2,140
17	97.7	900	2,260
18	103.5	950	2,380

EFFECT OF GROUND WIRE ON EXCESS VOLTAGE

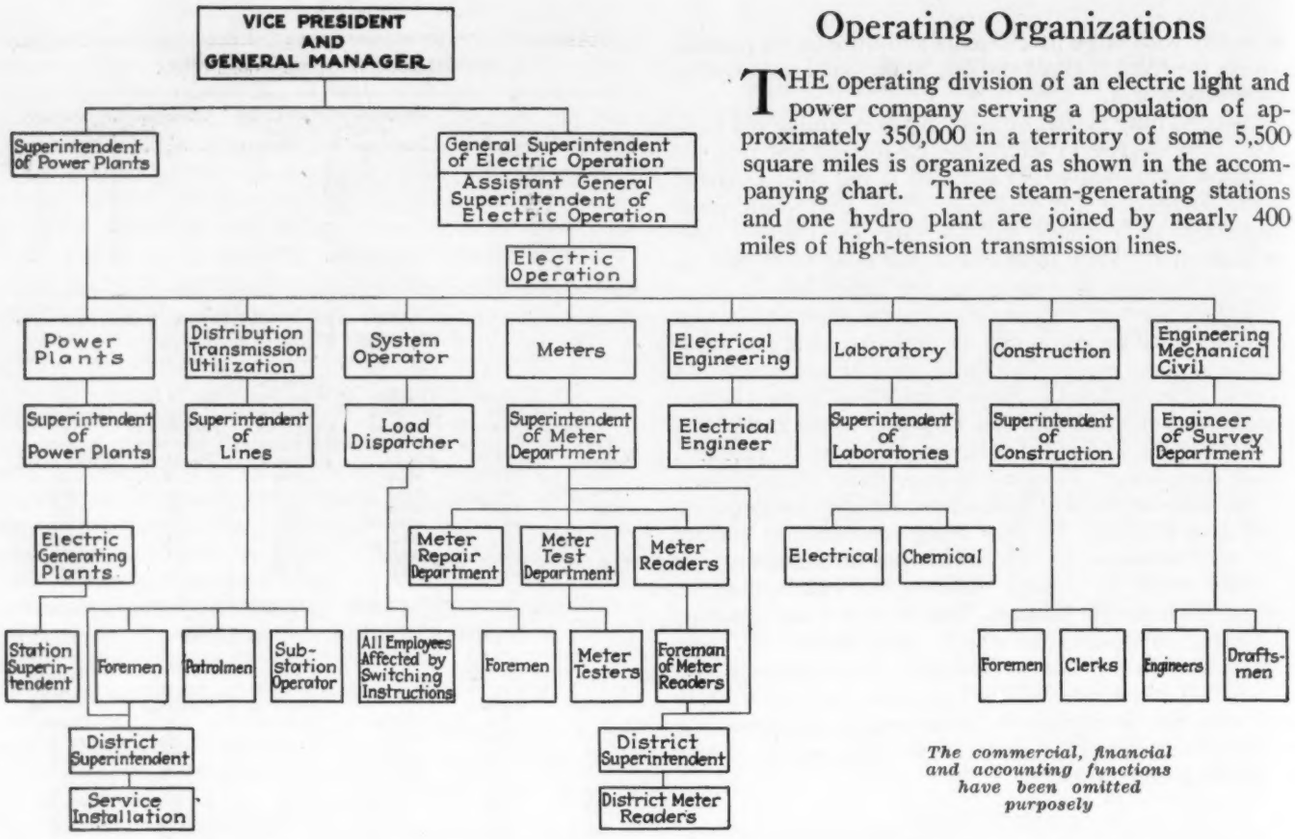
Protective ratio = Voltage with ground wire / Voltage without ground wire

o Indicates conducor
♦ Indicates ground wire

Conductors Vertically Arranged			Conductors Horizontally Arranged		
Arrangement	Protective Ratio	Per Cent Decrease In Excess Voltage	Arrangement	Protective Ratio	Per Cent Decrease In Excess Voltage
♦ o o	(1) 0.42	58	♦	(1) 0.45	55
o o o	(2) 0.52	48	o o o	(2) 0.45	55
o o	(3) 0.62	38	1 2 3	(3) 0.52	48
♦ ♦			♦ ♦	(1) 0.37	63
o o	(1) 0.33	67	o o o	(2) 0.32	68
o o	(2) 0.39	61		(3) 0.37	63
o o	(3) 0.48	32			
♦				(1) 0.50	50
o o	(1) 0.40	60	♦	(2) 0.44	56
o o	(2) 0.45	55	o o o	(3) 0.50	50
o o	(3) 0.42	58			
♦			♦ ♦ ♦	(1) 0.30	70
			o o o	(2) 0.27	73
♦				(3) 0.30	70
o o	(1) 0.46	64			
o ♦ o	(2) 0.38	62	♦	(1) 0.32	68
o o	(3) 0.44	56	♦ o o o ♦	(2) 0.28	72
				(3) 0.32	68
♦ ♦ ♦					
o o	(1) 0.28	72		(1) 0.34	66
o o	(2) 0.33	67	♦ o o o ♦	(2) 0.31	69
o o	(3) 0.41	59	♦	(3) 0.34	66

Operating Organizations

THE operating division of an electric light and power company serving a population of approximately 350,000 in a territory of some 5,500 square miles is organized as shown in the accompanying chart. Three steam-generating stations and one hydro plant are joined by nearly 400 miles of high-tension transmission lines.



The commercial, financial and accounting functions have been omitted purposely

Pulling Cable and Erecting Poles

THIS overhead-underground junction is being installed by pulling the cable through the conduit riser with a truck winch. Pulling blocks attached to the top of the pole and near the base permit translating the horizontal tackle tension at the winch into vertical pull at the top of the riser. A mesh-type cable grip is being used on the end of the cable. The iron-pipe tripod boom with which the pole is being erected has a pulley in its outer end, an adjustable length top leg, and is readily demountable where headroom or overhang is restricted. Both jobs are being done with a 3-ton International Harvester motor truck equipped with auxiliaries. The truck has been kept busy virtually all the time since its purchase in 1926 by the Richmond (Ind.) Municipal Electric Lighting & Power Company for building new lines, removing old, pulling cable, installing heavy overhead equipment like transformers and hauling poles on a trailer.

Installing cable riser and pole with special equipment

Number of Customers in Seven Southwestern States

	1921	1927
Missouri (total)	376,000	676,500
Domestic		541,500
Commercial and power		135,000
Kansas (total)	227,000	327,100
Domestic		274,600
Commercial and power		52,500
Oklahoma (total)	142,700	232,800
Domestic		176,950
Commercial and power		55,850
Texas (total)	307,500	667,800
Domestic		491,900
Commercial and power		175,900
Louisiana (total)	93,421*	136,100
Domestic		104,300
Commerical and power		31,800
Mississippi (total)	41,400	65,300
Domestic		51,500
Commercial and power		14,150
Arkansas (total)	100,254*	131,200
Domestic		107,100
Commercial and power		24,100
Grand total		2,236,800
Domestic		1,747,850
Commercial and power		489,300

*Refer to 1923; 1921 data unavailable.

Plans for Lightning Tests

Specific and conclusive answers to existing questions must be obtained. Field investigations under way in Tennessee and Illinois. Speculations. A joint responsibility

By A. L. ATHERTON

Supply Engineer Westinghouse Electric & Manufacturing Company

DURING recent years there has been a growing realization of the fact that lightning voltages constitute one of the most serious remaining hazards to reliable transmission of electric power over long distances. We can see vast savings from interconnections of systems into "superpower" groups and we can see great possibilities of utilizing remote water-power sources, but we can only realize these benefits if transmission is reliable. And today transmission is not sufficiently reliable in territories where lightning storms are prevalent, which means in practically the whole industrial territory of the country.

There has been a thought that 220-kv. line insulation will be sufficient to withstand lightning voltages, but experience has shown this to be wrong. There have been several "lightning-proof" lines designed and built and these have been flashed over like the rest. Ground wires have been looked on by some as a panacea, but lines so equipped still flash over sometimes.

The industry is going ahead, planning and counting on reliable transmission, and getting it only when lightning permits. The corrective schemes which have been tried have all eventually been shown to be inadequate in some measure. The realization is growing that we are dealing with a force which cannot be reasonably resisted and overcome, but which must be recognized and treated as an operating condition and controlled; that we cannot insulate against lightning but must protect against it or render it innocuous.

But the way is far from clear. We cannot deal with any assurance with an unknown force and much is still unknown. What is the nature of these voltages, how fast do they rise, what values are reached, how long do they last, are they all of one polarity, are they oscillatory? Is the problem the same in nature at low voltages and high, or are the dangerous cases on the highest voltage lines all due to "direct strokes" on the line, while bound charges released on low-voltage lines become dangerous? How fast does the cloud discharge and to what extent can the released energy flow out along the line and limit the voltages while the cloud discharge is taking place? Is the cloud discharge so slow that no dangerous voltages really arise from the release of bound charges, leaving direct strokes as the only source of dangerous voltages on any line? If our past conception is wrong and a large proportion of the seriously dangerous voltages are due to direct strokes, is our other conception also wrong, that such direct strokes are so violent as to be beyond control? These and other questions must be answered before we can know what should be done, and they can all be answered when the first is fully answered.

In 1923 Peters* conceived the idea of using Lichten-

*"*The Klydonograph*," J. F. Peters, *April 19, 1924*, ELECTRICAL WORLD.

berg figures to measure the magnitudes of these voltages and out of this conception grew the invention and development of the klydonograph. This instrument has had wide use and has already told much that was unknown before, but it has not told all we need to know. It tells the maximum value and polarity, but not the rate of rise or duration, and thus gives no good clue as to what value would be reached, if flashover did not impose a limit. This limitation also leaves us without full knowledge as to the kind of insulation to make or the characteristics to seek in protection.

The recognition of the need for fuller knowledge is international. In Germany a society for the study of highest voltages has been organized and work is being done under the guidance of Matthias, Ragowski, Binder and Orlich with the assistance of Gabor, Flegler, Grosser, Summer and Tamm. In England Simpson is continuing his observations and studies. In Switzerland the problem is being studied by the Swiss Association of Electricians, under the direction of Taller with the assistance of Berger.

In Sweden Norinder has worked for eight years almost wholly on this problem, and his work has thrown the most light on the problem and gives the most promise for an early solution. His ingenious adaptation of the cathode-ray oscillograph has made possible for the first time direct and complete oscillograms of lightning voltages as they appear on circuits in service. The major problem, that of starting the oscillograph in anticipation of the arriving transient, is solved. And his present affiliation with the Westinghouse company has brought this device, experience and knowledge to bear on the problem in this country, where the need is possibly the greatest.

The time since Dr. Norinder's visit here has been short, but plans are made to put some of his oscillographs to work here this summer. Instruments with the necessary accessories are to be installed on the Cheoah-Alcoa line of the Knoxville Power Company in Tennessee and on the Chicago Heights-Joliet line of the Public Service Company of Northern Illinois. Each installation will consist of an oscillograph with accessories, a series of klydonographs for extending the scope of the data along the circuit, means for determining the location of the cloud discharge relative to the point of connection of the oscillograph and cameras for photographing the flash. The choice of locations was made to combine severity and frequency of lightning storms with a highly insulated line in a general district of industrial importance, where the need for reliable transmission is or will be great.

The mountains of eastern Tennessee are in a district of nearly maximum frequency of storms. The Cheoah-Alcoa line at one point crosses these mountains near the western end of the Chilhowee range, where it is exposed to storms from both southwest and northwest. It is insulated with ten units for 154-kv. operation, yet flashover is not uncommon. Access is somewhat difficult, but the conditions are otherwise so favorable as to make this relatively unimportant.

The Chicago district is in a territory of less natural lightning severity but greater industrial significance. The territory traversed by the Chicago Heights-Joliet line is the direct antithesis of that in Tennessee. The ground is flat and level and the line characteristics almost unchanging for miles. Moisture is near the surface, so that the height of line above the earth potential plane is quite definite. The line is insulated for 132 kv. operation. The work of installing the oscillographs and other equipment is going on rapidly and operation should commence shortly.

It is perhaps of interest to speculate on the probable results in order to predict and anticipate the present practices. In such speculation one is guided by the results which have been secured with the klydonograph† in this country and by Dr. Norinder's‡ oscillograph in Sweden.

The klydonograph studies have indicated that the voltages are in two general groups of magnitude, with an open band between them. The cause of this is probably of little significance so far as protection practice is concerned, but the determination of the cause will help to understand the fundamentals and thus be of great value. The cause may be any of several. The high voltages may be direct strokes and the others induced. There is a predominant polarity for each group and this suggests the correctness of Simpson's¶ hypothesis that the negative and positive cloud discharges behave in a radically different way and that the high voltages result from direct negative strokes, while the lower voltages are a result of induced negative and direct positive strokes. In view of the variable nature of the phenomena it may simply be that the available information is not sufficient to permit the drawing of any sound conclusions.

The highest voltages measured with the klydonograph, approximately 2,000,000 volts on lines insulated with fourteen standard suspension units, have in general accompanied flashover on the line. Laboratory results on the same kind of insulators indicate that the only way such high values of voltage can be reached across these strings is by applying a very rapidly rising voltage, so that the "overshooting" beyond the value for 60-cycle crest flashover is considerable. The information as to the characteristics of such voltages is derived by

Organized National Support Essential

The problem is not that of the manufacturer alone; it may be more nearly the problem of the operator, and it surely concerns the whole industry.

* * *

It will not be promptly and well solved if it is left to the efforts of any individual unit of the industry or even to disorganized effort on the part of many such units.

* * *

It requires organized national effort in collecting data and a central agency for coordinating the efforts, and for receiving, analyzing and disseminating the data.

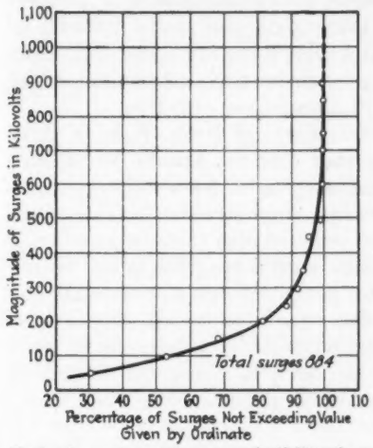
†*"Klydonograph Surge Investigations," J. H. Cox, P. H. McAuley, L. G. Huggins, Transactions A.I.E.E., Vol. XLVI, pages 315-329.*

‡*H. Norinder Lightning Surges, Journal of Frauddin Institute, June, 1923. "Electric Thunderstorm Field Researches,"* ELECTRICAL WORLD, *Feb. 2, 1924.*

¶*G. C. Simpson on Lightning, Proc. of Royal Soc., May, 1926, "Mechanism of Thunderstorm," April, 1927.*

inference from other tests and many engineers have failed to accept any of the various explanations.

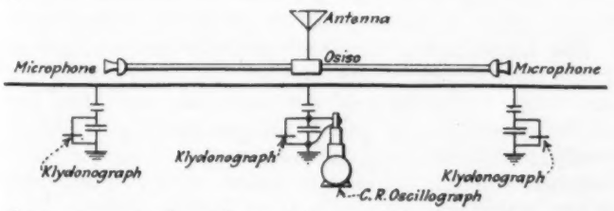
Definite information as to the shape of the voltage time relation at two points on the line, taken together with crest value indications at several other locations and indications as to the location of the cloud discharge and photographs of the cloud discharge, will lead to much clearer conceptions not only as to the nature and source of these very high voltages but also as to the way they behave as they are transmitted along the circuit, and thus help in establishing the basis for line and apparatus design and application.



Relative percentage of lightning surges of various magnitudes

The indication as to whether all the very high voltages are of the kind accompanying flashover along the line, together with further light as to the reduction in value and change in shape of such voltages which take place as the wave travels, and specifically the information as to whether voltages of relatively high magnitude and long duration which will travel with relatively small attenuation really occur, will throw much added light on the general question of the economic justification of lightning arresters at stations on very high-voltage circuits.

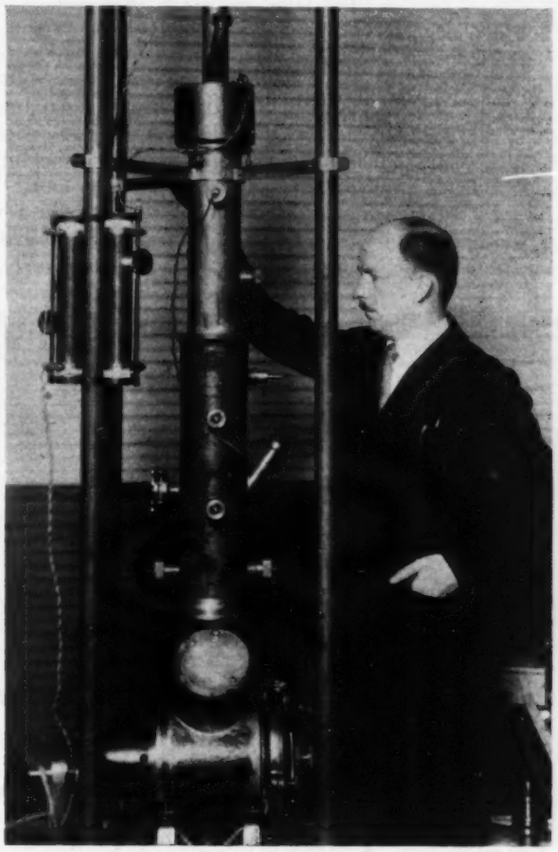
If the only voltages which might be dangerous to very high-voltage apparatus are those resulting in flashover along the line and which are thus reflected back on the line so that only a small part reaches the stations, it seems that the effort toward protection should be directed at the line rather than at the terminal apparatus. This might lead toward extension of the use of overhead ground wires or toward the use of some of the proposed devices for permitting flashover but controlling the follow of power current as by the use of a fuse. It might lead to the adoption of the principle of using many lightning arresters of the now conventional types distributed along the circuit. Such arresters would have to be small in size and low in cost,



Arrangement of equipment for studying lightning surges

and they might properly be of low individual capacity. They should be proportioned not only to reduce the voltage where and as it arises but also to absorb and dissipate the surge energy and thus to prevent or greatly reduce propagation along the line. The nature and frequency of occurrence of the dangerous voltages will tell if such schemes are feasible and, if they are, how to work them out.

Calculations on the efficacy of ground wires are all based on the assumption that the dangerous voltages are induced. As Peters has recently pointed out, if a direct stroke passes by a ground wire and hits the line conductor, the ground wire can do little good, and if all or many of the dangerous voltages are due to direct strokes, ground wire construction should be designed and installed to serve the function of a lightning rod to intercept direct strokes rather than to reduce the voltage of induced charges. In such a case some precautions



Cathode-ray oscillograph which will make records of lightning surges

would probably have to be taken against damage to apparatus due to voltages magnetically induced in the line conductors. Oscillographic study on transmission lines protected by a variety of ground wire arrangements may be necessary.

Much valuable information may be thrown on the general value of present day or future protective devices by direct oscillographic study of the operation of such devices in service.

It may be entirely possible that the future plan for transmission line construction will take into account incident lightning conditions in the local topography. Oscillographic studies on lines in various kinds of topographical conditions, if carried on in a broad enough way, would determine whether such a course is worth considering.

It is recognized that the amount of information which will be secured from the tests now contemplated will not be sufficient to give all that is needed to settle the points of uncertainty in a reasonable length of time, even though the quality of the information is sufficient. Future work will be required on a broader scale. More-

over, some modification of conditions will also probably be required, after the first information is secured and the limitations established in a preliminary way.

For example, if it develops that the highest voltages are always accompanied by a flashover, as might be expected in the light of the present information, it may be found to be worth while to carry out the proposal to which some consideration has been given of constructing a "super-insulated" line a few miles in length, so built that insulation far beyond the practical limits is provided. Disregarding cost, the most desirable procedure would be to overinsulate this line to the extent of preventing flashover, regardless of the incidental conditions, thus making it possible to measure the voltage phenomena uninfluenced by line limitations. An intermediate step which can probably be better justified economically would be to insulate a section of some high-voltage line for two or even three times the limits set by present economic considerations and to extend the tests to these lines. We could thus determine whether the voltages which now cause flashover are of such an extreme inherent magnitude as to make further overinsulation within even these extended limits of no benefit, and also make a closer determination of the source and nature of the flashover voltages.

Whose Responsibility and Interest?

The amount of work to be done is tremendous. It must be extended over some years. It must be done in many locations over the whole area where transmission is needed and lightning is a hazard. To be of greatest value, the data for the various locations must be gathered simultaneously. The problem is not that of the manufacturer alone; it may be more nearly the problem of the operator, and it surely concerns the whole industry. It will not be promptly and well solved if it is left to the efforts of any individual unit of the industry or even to disorganized effort on the part of many such units. It requires organized national effort in collecting data and a central agency for co-ordinating the efforts, and for receiving, analyzing and disseminating the data. It is to be hoped that some of the national organizations of the industry will undertake to set up such a co-ordinated activity.

As a stimulus to such an end, as well as to stimulate discussion and thus to make these first efforts of greatest immediate benefit to the industry, it is the intention to make public the results of the tests as soon as they become significant.

Carrying Model Farm to Rural Districts

A WELL-PLANNED and completely equipped electrified farm is no doubt the best means of demonstrating the value of electric service in farm operations. Demonstration farms have drawn thousands of farmers and farmers' wives to investigate and study methods of farm electrification. However, there are some limitations as to location and distance to be traveled beyond which the demonstration farm becomes less effective.

The colleges and universities of Iowa, Kansas, Missouri and Nebraska, together with the Middle West Division of the National Electric Light Association, decided that such a plan of education and extension service would be worth while, but they realized also that the number of farms necessary to carry on such a program in the Middle West was too large to make the plan practical. So instead of arranging for farms to which the farmers would come, they built a miniature model farm, fully equipped, which could be taken to many hundred thousand farmers in important locations of the four states.

How model electrified farm is assembled for exhibition

Complete plans and specifications were drawn by specialists in agricultural engineering, architectural engineering, landscape architecture, electrical engineering and household administration of Iowa State College and the "plant" was built on a scale of a half inch to one foot.

Every detail of an actual farm is carried out in miniature. Electric service is supplied by a 6,600-volt, single-phase line which passes along a secondary road. The transformer is located on a pole in the yard so that convenient service has been extended to all buildings and proper regard has been given to safety and clearances.

The farmhouse is fully equipped with modern lighting, radio, convenience outlets, an electrical kitchen with electric range, refrigerator, electric sink and ventilating fan. In the basement the laundry is equipped with electric washing machine, flatiron and ironer and hot water is supplied through an electric heater and an electrically driven water system.

Outside of the house the yard court is lighted with a two-bracket fixture and additional bracket lamps are mounted over doorways where needed. For the farm the following electrical equipment is installed: Motor-driven milking machine, cream separator, sterilizer, portable elevator, chore motor, motor-driven repair shop, electrically heated incubator, brooder and oat sprouter.

This model farm is being exhibited under the auspices of the Middle West Division, N.E.L.A., rural electric service committee, of which J. E. Hillemeyer is chairman.

Accounting for Depreciation

Types of depreciation reserves. Methods of accumulation. Policies of charging depreciation against reserve. Special features

By W. G. Cross

Assistant Valuation Engineer Southern California Edison Company, Los Angeles, Cal.

IN ORDINARY utility accounting practice provision is usually made for the wearing out of an item in service by accumulating amounts which in total will reimburse the utility for the property at the time the item is abandoned. The existence of accrued depreciation plays very little part, if any, in utility accounting and the only connection lies in the fact that if depreciation has occurred on an item in the utility's service there is likely to be some sort of an accumulation in its depreciation reserve. That the amount in the reserve is not necessarily a measure of the accrued depreciation may demand that a certain sum be set aside for the year's annuity to the fund, but if business conditions have been such with the utility that money is not available to so set aside the amount the management may be thoroughly justified in making no accounting provision at the time, waiting for a more suitable financial period.

Certain peculiarities in the nature of the items may cause depreciation reserves to be accumulated on other than a standard basis. Land, for instance, ordinarily requires no reserve when located in a growing community, due to the fact that appreciation commonly

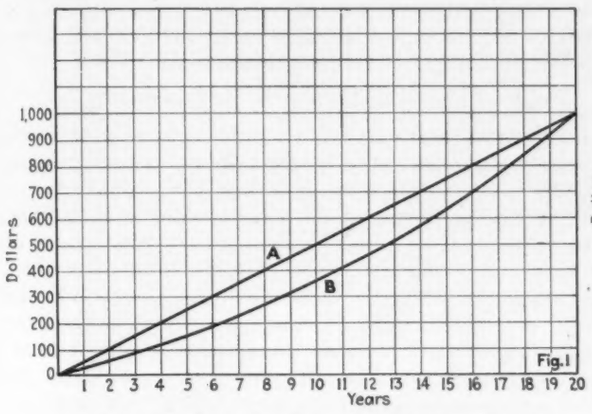


Fig. 1—Straight line and sinking fund reserve accumulations

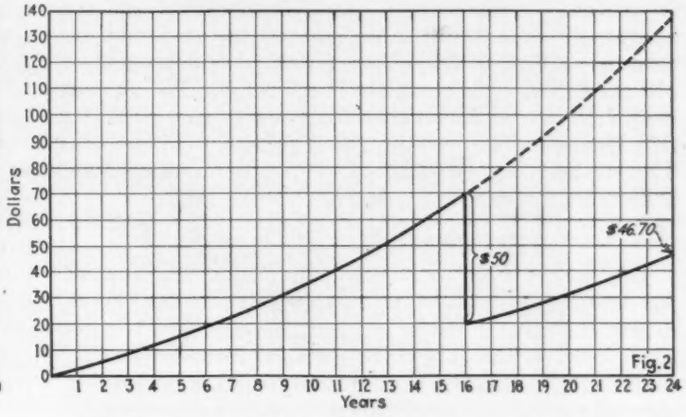


Fig. 2—Depreciation annuity for composite item with two elements having different lives

Fig. 1—*A* straight line basis without interest; *B*, sinking fund basis with fixed rate of interest.
Fig. 2—The curve shows that the direct average life of twenty years is incorrect for two poles, one having a life of sixteen years and the other 24 years, when determining average life for sinking fund annuities.

must be evident from what has already been demonstrated in previous articles under the above title and the principle has been expressed many times in court decisions. It is, of course, known to the reader that modern utility accounting does not allow "writing down" of capital investment on account of depreciation.

The idea of formation of a depreciation reserve is mainly due to the fact that public utility regulation annunciated the principle that rates should be based upon cost of service, including an adequate return on the investment, and that cost of service obviously included the wearing out of apparatus devoted to the service of the public. As determinations of cost of service are commonly based upon yearly estimates, it became natural to show these accumulations against the future wearing out of the item in the form of annuities, and this practice is in general use at the present time with most utilities.

There is a distinct difference between the theory of depreciation reserve accrual and actual practice. Theory occurs and usually more than offsets such functional depreciation as may occur due to unforeseen circumstances. A question arises, however, where in order to purchase a special site required for some plant, or right-of-way required for transmission or distribution lines, the company is held up and forced to pay much more than the market value. In such cases it may be doubtful whether appreciation is sufficient to take care of the fact that the future salvage price will probably be less than original cost. It would undoubtedly be very hard to induce a regulatory commission to see the justice of providing a reserve, or amortization fund, against this future loss, but such conditions do actually exist at times.

Peculiar circumstances may require depreciation reserves to be accumulated on other than a uniform basis. An example might include a stone quarry, known to contain a certain amount of rock, for which a depletion reserve could be set aside either on a yearly basis or a basis corresponding to the quantity of stone removed. If it were known, however, that with the exhaustion of the

quarry the pit could then be used as a dump with a revenue derived therefrom, such a condition would allow the possibility of three annuity methods, one taking care of the depletion up to the end of life of the quarry and making no allowance for the subsequent revenue; the second might consider depletion activities sufficient partially to reimburse the cost at the end of life of the quarry, relying upon revenues to provide the balance, and the third might extend the annuity over the entire life of quarry and dump taken together, making allowance for revenues and thus requiring a very small annuity.

Decision is then made as to the manner in which the accumulation shall be effected. Often this is not left to the discretion of the utility, but is prescribed either by the action of the regulatory commission or by the theory of rate fixing under which the utility is operating. The theoretical aspect of the method of using cost to reproduce new, less depreciation, as a rate base requires the accumulation of the reserve on the straight line basis. In other words, if twenty years, for example, be used, one-twentieth of the base figure would be set aside annually to the reserve.

In many cases the utilities are required to accumulate the reserve on a sinking fund basis. That is, with some definite rate of interest established, the annuity is so determined that, with the addition of compound interest, it will accumulate the base figure at the end of the period. In the case of the twenty years mentioned above, the assignment of a 6 per cent interest factor would require an annuity of $27.18 per $1,000 of base, as against $50 per $1,000 on the straight line method. The amount of $27.18 set aside annually for twenty years at 6 per cent compound interest produces the required amount. The straight line basis is, of course, the sinking fund basis with a zero rate of interest.

Methods of Accumulation

The service unit basis does not ordinarily allow of any latitude in the method of accumulation, for, by its nature, the annuity must represent the quantity of output lost forever. The application of some forms of sinking fund method would be very difficult, if not impossible, in view of the non-uniform nature of each year's annuity. If annuities are set aside on the sinking fund basis, the fund must be credited yearly with interest on the amount therein at the rate under which the annuity was predicated. This, in effect, is making the erroneous statement that interest rates to utilities are stationary and will remain the same in the future, for the theory on which regulatory commissions require the reserve to earn interest is that the reserve accumulation may be invested in plant and that the money so invested is comparable to and takes the place of money which would otherwise be borrowed from investors at the interest rates prevailing for this type of risk. But we know that interest rates do change, and at the present time there appears to be a definite trend toward reduction, and if regulation of the future should require a lower interest rate on rate base, and consequently on depreciation reserve, the proper accumulation will not be on hand at the time of retirement. Here is a question worthy of serious thought, and one to which no definite and logical answer has as yet been forthcoming.

On the other hand, complete items for which the reserve was designed should be retired from the reserve if the average life assigned to that certain class of items has been correctly determined, even though in an account such as "Poles and Fixtures," for example, many poles will have a life very much less than the average, while others will have lives much exceeding the average.

In discussing the formation of life tables there was mentioned the difficulty of determining average lives for composite properties. This thought may be further amplified by making the statement that, theoretically, average life determined for a straight line annuity calculation is not the same as average life determined for a sinking fund calculation. In the case of a composite item, composed of two poles, one of which, it is known, will have a life of sixteen years and the other a life of 24 years, the average life, correct for a straight line annuity calculation, is twenty years, but this figure is not correct for a sinking fund annuity calculation, the figure for this average being something in excess of nineteen years. This may be clearly established by reference to Fig. 2, which indicates the accumulation of a depreciation annuity for these two poles on a 6 per cent sinking fund basis, assuming a total $100 cost. At the end of sixteen years $50 is taken from the accumulation, for the retirement of the first pole, leaving approximately $20 at that date. This amount again accumulates interest, together with the $2.72 annuity, until in the 24th year the second pole ceases its usefulness. There is only $46.70 in the fund for this purpose at this time, however, indicating that the direct average is not correct when determining average lives for sinking fund annuities. The average life of a composite property is always less than the mathematical average when determining average life for compound interest calculations.

Reserve for Uniform Retirements

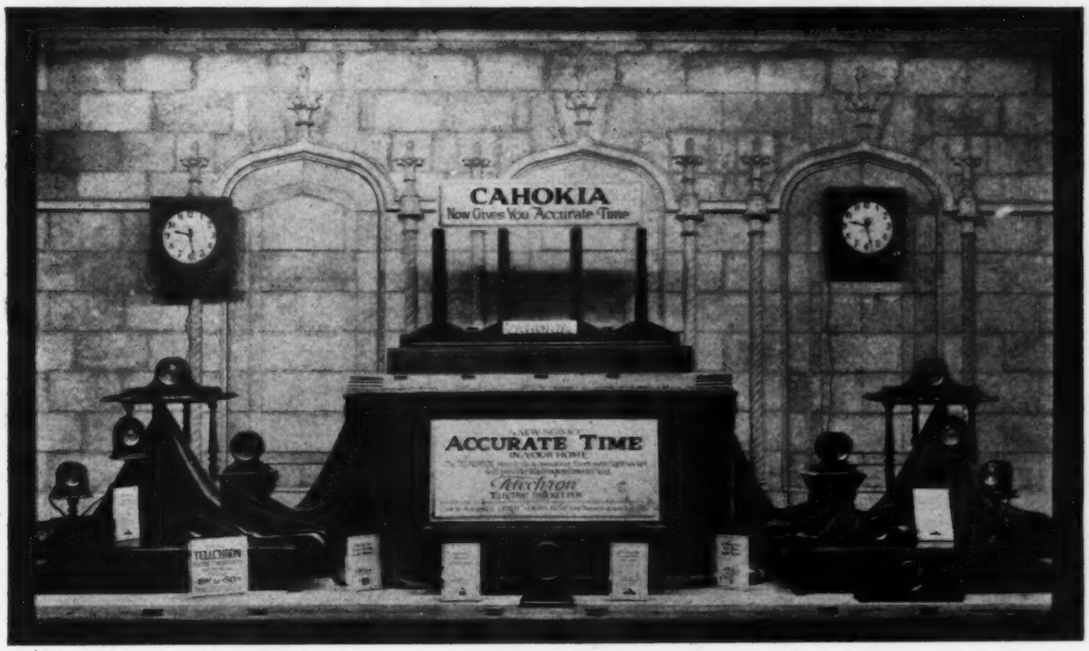
In general, the reserve for a public utility with fairly uniform retirements must lie somewhere between nothing and 50 per cent on a straight line basis and between nothing and 36 per cent on a 6 per cent sinking fund basis, with corresponding percentages for other rates of interest. Under special conditions of accumulation which might involve the retirement of some especially large pieces of equipment, or depletion reserves where the entire property will at some future time go out of existence completely, it may be perfectly correct for the reserve to accumulate to as much as 100 per cent, but these are special cases. The annual retirements of a utility with a rapidly growing property may be less than 1 per cent of the total investment. A conclusion that the reserve is sufficient if comprising an amount comparable to these latter figures is definitely erroneous, for the accumulation in trust is meant to take care of not only the current year's retirements but also to cover the accruals required toward the period when other items, now more or less new, will then have to be removed. In general, it will be found that there are very few cases of operating companies where the depreciation reserve should be less than 10 to 15 per cent of the operative property on the straight line basis and 5 to 10 per cent on the sinking fund basis.

The test of correctness of the reserve can best be made by grouping the various elements of the property into conveniently handled composite items, estimating the average age of the composite item, taking into consideration the sinking fund foreshortening mentioned, and computing the accumulation that should be in the reserve on whatever basis is fundamental for the utility. Such a method should be followed at intervals in order to make sure that the company's accounting practice has not deviated from the fundamentals established and drawn the reserve down to a point below its proper condition.

Correct Time— for Public Relations

Some experiences in a number of cities where correct time has been made a central-station service

By Earl Whitehorne



St. Louis company's window exhibit for selling electric time

PEOPLE are so perpetually dependent upon correct time in our modern, high-speed world that the idea of having the power company become the general benefactor to the community by maintaining a service of correct time was very appealing from the outset. After all, there are just three natural objectives in the back of the utility executive's mind—to provide a dependable service, to make a profit and to maintain good public relations. And good public relations are vital to growth, to prosperity and to peace of mind. It is therefore often worth while to do things that seem to offer no possibility of direct profit because good-will will come out of them. For good will is profit.

Therefore when the master clock for frequency control became available so that the alternations of the current could be made to operate clocks for any customer with uncanny accuracy the idea of correct time as a new central-station service was much discussed in the industry. The public need for such a service had been conspicuously demonstrated by the experience of the telephone companies. For during the World War, when the demands of telephone service began to tax the communication facilities, they discontinued this past practice of having their operators give the correct time to any inquirers. The demands for this information had gradually grown to tremendous proportions, and when it was stopped countless thousands who had been setting house clocks and personal timepieces by calling "central" had to fall back once more upon the chronometer in the jeweler's window or the Western Union wall clock in some office or public building. The public felt much inconvenienced and for a time aggrieved.

It was an opportunity for some one else to step in and the development of the "Telechron" system of correct time from clocks connected to the nearest convenience outlet made it possible for the power company to become the timekeeper for the town. Many companies installed this master clock frequency regulation in their stations and began the service of correct time. Some have now been selling and serving these clocks for about ten years and correct time is now obtainable from the house circuits in more than 5,000 communities in America. These communities are widely scattered and include the following states: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Ken-

tucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Virginia, Washington, West Virginia and Wisconsin. These towns are, of course, served by many separate operating companies where systems are regulated for this service of correct time. The experience of some of these companies is interesting.

In Pittsburgh the Equitable Sales Company, which is the merchandising organization of the Duquesne Light Company, sold 1,993 telechrons in 1927 as the result of a consistent sales activity in which these clocks were displayed in twelve stores and three outside salesmen were engaged in active canvassing, principally on commercial prospects.

Advertisements of Nebraska Power Company.

The sale of telechrons began on Jan. 2 and five newspaper advertisements were run, at a cost of $3,500. After that newspaper space was occasionally devoted to clocks and some $800 was spent and also 180,000 folders were distributed by meter readers at a cost of $350. Also a "Time-of-Day Service" was established by the Duquesne Light Company and the public was invited to rely on the power company for correct time. On the first day 950 calls were received. Within a year more than 9,000 calls were recorded in a single day. It is expected that this service will ultimately average about 10,000 calls daily, several operators being employed all day and part of the night in giving out "electric time."

Another very effective form of advertising has been the use of the radio. Correct time is given by the "Telechron" electric clock six times daily from station KDKA, Pittsburgh. Time is broadcast at 9:45 a.m., 4, 5, 6 and 7 p.m. and when signing off. The announcer also states that these clocks are sold at the eleven gas and electric shops in Pittsburgh and suburbs. This time service has been very valuable in the sale of telechron clocks and many distant inquiries have been received. One came from Pensacola, Fla., where the operator of the municipal station wanted to know where he could buy a "Telechron" clock for use in announcing time from his studio. This radio advertising costs $6.25 daily.

Only 30 service calls were received in Pittsburgh during the year. The bulk of the business was sold on deferred payments, 10 per cent down and ten monthly payments. The salesmen are paid a commission of 15 per cent on time payment sales and 20 per cent on cash or 30-day sales. Where the customer requires an outlet to connect the clock it is sold at a flat price of $7 or $5 in some localities.

Experience in Omaha

The Nebraska Power Company began a service of correct time late last fall and in the first three months sold 464 clocks, 230 of which replaced self-winding clocks in business places. Vice-President James E. Davidson says: "Any company selling electric timepieces must, of course, make it known that its customers can call the company's telephone operator and obtain the correct time, if need be, by which to set their clocks should the clocks stop by reason of interruption to service. This seems to encourage other customers, who do not own "Telechron" clocks, to call the telephone operators and obtain the correct time, particularly because they know that the time is correct, by reason of the advertising done. We find that the calls amount to a considerable number. For instance, in October we had 2,071 calls, in November 2,134 calls and in December 2,363 calls, all for 'Telechron time,' yet we had practically no interruption to service. Any interruption that we might have had would have been on only one circuit.

"We have now persuaded the WOW broadcasting station, Omaha, to give the 'correct Telechron time' over its station three or four times a day, stating that the service is through the courtesy of the Nebraska Power Company. This is very good advertising and a service that is looked upon with favor by the public. We have found that the profit made in the sale of clocks helps materially in building our merchandise profit.

"Now that we have introduced the 'Telechron' clock, we have advised the electrical trade that we do not care to be the exclusive agent, so from now on these clocks will be sold by some of our leading jewelry firms and one or two of our department stores. We did this from a public relations point of view, because we found that the dealers were complaining that because we were now selling electric clocks they could not sell the old-style spring-wound clock."

The sale of these clocks has been supported by window displays in this company's store, by newspaper advertising and the distribution of small folders. Mr. Davidson adds:

"Our actual selling experience has been most satisfactory. We have never merchandised anything that has attracted more favorable attention and, best of all, this

favorable impression continues. People with whom I do business and those whom I meet socially voluntarily speak enthusiastically of their 'electric clocks.' The confidence inspired in the homes and in places of business through these clocks makes for more confidence in our electric service. I predict that within a few years 90 per cent of the medium and higher priced clocks sold will be electrically operated. The "Telechron" consumes about 9 cents worth of electricity a year.

Other Cities

The Philadelphia Electric Corporation sold about 100 clocks in one 60-day campaign and later 500 in a three weeks' drive. In a period of four years it has marketed approximately 1,500 "Telechrons," principally as a result of direct-by-mail advertising consisting of broadsides and also by stuffers sent out with light bills. Experience in Philadelphia has been that these clocks are best sold by approaching men in their offices, women apparently being far less interested, presumably because they are personally less dependent upon the correct time.

In St. Louis the Union Electric Light & Power Company sold about 300 clocks in the first four months of its interest in a service of correct time, at an expense of $1,040 for advertising, sending out about 2,000 each of a series of folders and supporting them with newspaper ads, but no outside selling.

Using the same general methods, Brooklyn has sold more than 1,200 clocks, Long Island City 500 and Chicago 1,000 in various periods of activity. The Boston Edison Company has been a pioneer in furnishing this service of correct time and featuring it over its broadcasting station. Its first master clock was installed in the fall of 1916. The principal point of interest seems to be the fact that a large number of power companies have now experimented with the idea and satisfied themselves that it is a good one. As one executive says:

"The value of this service of correct time as an influence for better public relations we cannot directly measure. I think it is a fact that the cumulative effect of the many different services we offer the public has resulted in the very excellent public relations we enjoy, but to attempt to specialize any information on this subject is almost a hopeless task. We have had practically no measurable reactions from the sale of these clocks. The outstanding fact has been that we have had no complaints and very few calls for correct time. Personally, from this record I draw the conclusion that the customers are entirely satisfied with their purchases, and if this is a fact the good-will building quality of the article is there."

Certainly it is a splendid thing to have the public look to the power industry for this essential service and to have it continually reminded as it listens to the radio that at last, thanks to electricity, the old annoyance of unreliable clocks is over. And "Telechron time by the courtesy of the power company" is now being broadcast daily by the following stations: WADC, Akron; WBZA, Boston; KYW, Chicago; WENR, Chicago; WHN, New York City; KGO, Oakland; WOW, Omaha; KDKA, Pittsburgh; WGY, Schenectady; WBZ, Springfield; WIBW, Topeka; CKNC, Toronto; WOAX, Trenton.

It is to be hoped that eventually every community that enjoys the use of modern electric service will have this added comfort to be thankful for—a new bond of friendship between the public and the power industry.

Canadian Utility Office Attractively Planned

FORT ERIE, ONT., has a new electric shop and office building just opened by the Canadian Niagara Power Company, Ltd., which is designed to be more than merely a place for offices and for the display of electrical appliances. The company desired to provide a new and much-needed community center and attention was given to constructing a building which would be pointed out by residents as one of the worth-while sights of the district.

Spanish architecture has been used. The exterior is of white stucco with a red tile roof. The two-story tower is surmounted by an electric lantern and an electrically wound and illuminated clock will be placed in this tower to furnish the entire community with correct time. The interior has received similarly attractive treatment.

Five Minutes' Labor a Day Pays for Electric Service

By M. Luckiesh
Director Lighting Research Laboratory, National Lamp Works, Nela Park, Cleveland

THE average unskilled laborer now works four hours a day to pay for food for his family and less than ten minutes for lighting his home. In 1879, when the first electric filament lamps were produced, all artificial light was obtained from open flames. If the unskilled laborer at that time had used as much light, obtained from gas flames, as is now used in the average American home, which is still far from adequately illuminated, it would have cost him 2½ hours of labor per day. If he had used tallow candles to obtain the same amount of light he would have had to work 24 hours each day to pay his lighting bill. He earned $1.43 per day at that time, compared with $3.20 per day now. When we take into account the much lower purchasing power of money now the decrease in cost of light is even more striking.

Twenty years ago the cost of a 40-watt lamp was 27 per cent of the total cost of the lamp and the energy it consumed throughout a life of 1,000 hours. Now the cost of this lamp is only 8 per cent of the total cost of lamp and energy during its average entire life. Obviously, the cost of a 40-watt tungsten lamp is not one-tenth as important as its luminous efficiency.

The average family now spends less than 7 cents per day for electric lighting. It should spend nearly three

times as much, at the present average rate for energy, in order to enjoy convenient and adequate utilitarian lighting. If the average unskilled laborer receives 40 cents per hour, it is obvious that his lighting would cost him ten minutes' labor per day if he used as much artificial light as is used in the average home. But he does not; therefore, he works less than ten minutes a day to provide artificial light for his home. Assuming that the workman who now spends the average amount for electric lighting receives 80 cents per hour, then he pays only five minutes' labor each day for light in his home.

A recent survey shows that 47 per cent of the families in this country have an average annual income of $2,550. Since they spend about 1 per cent of this amount for lighting their homes, they also work about five minutes a day to pay their lighting bills. Surely the convenience, utility and psychological value of better lighting in the home is worth more than the earnings of five minutes per day for half the families in this country.

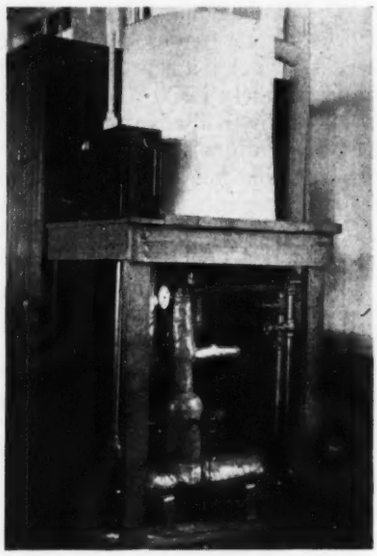
Even many persons whose annual incomes aggregate many thousands of dollars display an attitude toward the cost of lighting which plainly demonstrates an incorrect value scale. The lighting of the homes of these persons is paid for by the work of a fleeting fraction of a minute. Educational work in lighting should aim not only to show how to use artificial light but also to place it in its proper place in the scale of costs and values.

Electric Truck Data Cover Seven Years of Commercial Application

AS A result of seven years of operation of eight 2-ton electric delivery trucks Joseph Husson, president of the Eleto Company of New York City, presented the data tabulated below at the Electric Truck Conference recently held in New York. The Eleto Company is the delivery organization for Lord & Taylor and James McCreery & Company, New York department stores. The duty requirements of these vehicles involved freight pick-up and furniture transfer service in city service. Mr. Husson pointed out that, as indicated, with proper maintenance methods the costs at the end of the seventh year compare favorably with those in preceding periods.

Process Steam Supplied Electrically

WHEN the Littlestown Silk Company at Littlestown, Pa., decided to shut down its 150-hp. Corliss steam engine and purchase all its power from the Metropolitan Edison Company, a subsidiary of the General Gas & Electric Corporation, there remained the problem of efficiently providing a small amount of hot water and steam for processing. One need was for producing hot water to soak the raw silk. This problem was solved by the adoption of a "cold water" soaking oil. Another need for small amounts of steam was in the "setting" process. The silk as it comes from the winders is placed on frames and put in a "steaming chest," into which steam is allowed to enter for a fraction of a minute and then the silk is allowed to soak for a minute or more. This processing of the silk sets and hardens the fiber.



Electric steam generator applied to silk mill process

The provision of steam for this latter process is accomplished by the use of an electric steam generator. Essentially this consists of an immersion unit of the proper capacity inclosed in a "boiler." Several refinements are provided with this device, including: A pressure-operated device which cuts off the current at 35 lb. per square inch and throws it on when the pressure drops to 20 lb. per square inch; a pressure gage and safety valve; an automatic feed regulator to keep a uniform level of water in the boiler, and a steam dome 2 ft. in diameter by 2½ ft. high which gives a steam storage capacity allowing the use of a comparatively small heating unit.

Maintenance Costs for Commercial Electric Trucks

Eight Walker 2-Ton Electric Trucks

	1921		1922		1923		1924		1925		1926		1927		Average for Seven Years, 1921 to 1927, Inclusive	
	Per Mile	Per Day	Per Mile	Per Day	Per Mile	Per Day	Per Mile	Per Day	Per Mile	Per Day	Per Mile	Per Day	Per Mile	Per Day	Per Mile	Per Day
Mechanical Department																
Labor	$0.0030	$0.0644	$0.0011	$0.0247	$0.0007	$0.0155	$0.0040	$0.0753	$0.0046	$0.0795	$0.0013	$0.0217	$0.0009	$0.0148	$0.0022	$0.0409
Parts	0.0079	0.1591	0.0159	0.3207	0.0056	0.1121	0.0137	0.2553	0.0208	0.3580	0.0100	0.1667	0.0104	0.1718	0.0119	0.2187
Labor and parts	0.0109	0.2235	0.0170	0.3454	0.0063	0.1276	0.0177	0.3306	0.0254	0.4375	0.0113	0.1884	0.0113	0.1866	0.0141	0.2596
Body Department																
Labor	0.0048	0.0974	0.0117	0.2371	0.0265	0.5218	0.0221	0.4112	0.0145	0.2505	0.0161	0.2673	0.0109	0.1795	0.0153	0.2817
Material	0.0012	0.0244	0.0018	0.0360	0.0031	0.0614	0.0042	0.0773	0.0016	0.0269	0.0034	0.0565	0.0031	0.0525	0.0026	0.0479
Labor and material	0.0060	0.1218	0.0135	0.3731	0.0296	0.5832	0.0263	0.4885	0.0161	0.2774	0.0195	0.3238	0.0140	0.2320	0.0179	0.3296
Total Mechanical and body repairs, labor and material	0.0169	0.3453	0.0305	0.7185	0.0359	0.7108	0.0440	0.8191	0.0415	0.7149	0.0308	0.5122	0.0253	0.4186	0.0320	0.5892
Total mileage	36,316		36,209		38,303		32,451		31,979		32,714		31,369		239,611	
Total truck days in service	1,797		1,794		1,946		1,743		1,853		1,972		1,915		13,020	
Average miles per truck per day	20.2		20.2		19.7		18.6		17.2		17.6		16.5		18.4	
Average number of trucks operated per day	6.0		6.0		6.5		5.8		6.0		6.6		6.4		6.2	

With this equipment approximately 1,000 to 1,500 lb. of silk can be treated per ten-hour day. A 10-kw. immersion unit prepares the system ready for operation in about 35 minutes. Most satisfactory silk is obtained by opening the valve for 25 seconds, then closing and allowing the silk to soak for one minute. During this 25-second period the pressure drops from 35 lb. to about 15 lb., depending upon the size of holes used in admitting the steam to the chamber. About four minutes is consumed in unloading and reloading the chest. During this period the pressure is back to 35 lb. per square inch. The operation is not constant in this plant but varies as the silk comes from the winders. Current is not on more than half the time and 10 kw. provides ample capacity.

In the winter months steam could be used from the heating boilers, but if this is done it is necessary to keep the heating boilers up to about 12 lb. per square inch pressure. This was found to be unsatisfactory due to the extra attention needed at the boiler. With the vacuum heating system used in this plant the heating is carried on about 1½ to 2 lb. pressure and the firing done spasmodically by the "odd job" man. When it is attempted to use the heating boiler for the silk-treating process the "odd job" man's time is seriously handicapped. This complete steam generator outfit was installed by the plant's repair crew, assisted by the central-station power engineer. It cost approximately $250 complete.

Electric Melting of Brass Proves Economical

MORE than $1,000,000 a year is saved in the production of brass in Connecticut by electric melting, said Robert M. Keeney, in addressing the American Electrochemical Society at its recent Bridgeport, Conn., meeting. The industrial plants of this state have been very progressive in the application of electric heating to industrial uses, largely, as Mr. Keeney pointed out, because electric heating has shown a saving in over-all costs. The industries of Connecticut have approximately 35,000 kw. of industrial electric heating equipment, consuming over 100,000,000 kw.-hr. a year. Of the total capacity, 22,000 kw. is installed for the melting and annealing of non-ferrous metals.

NON-FERROUS METAL ANNEALING FURNACES IN CONNECTICUT

Plant No.	Application	Number of Furnaces	Kilowatts Each	Total Kilowatts
1.	Brass and aluminum tubing	3	350	1,050
	Copper tubing	4	120	480
2.	Copper tubing	1	390	390
3.	Brass shells	2	150	300
4.	Brass shells	2	150	300
5.	Condenser tubing*	1	500	500
6.	Nickel-silver stampings	1	60	60
7.	Nickel-silver stampings	2	80	160
8.	Nickel-silver stampings	1	100	100
9.	Nickel-silver stampings	2	100	200
10.	Nickel-silver stampings	1	45	45
11.	Brass shells	1	300	300
12.	Brass eyelets	1	80	80
13.	Miscellaneous, shells and sheet	1	150	150
	Miscellaneous, shells and sheet	1	250	250
	Condenser tubing*	1	500	500
14.	Condenser tubing*	1	500	500
15.	Condenser tubing*	1	500	500
	Total	27		5,865

*Annealing machines.

Letters from Our Readers

Loaded High-Voltage Cables for Capacitance Correction

To the Editor of the ELECTRICAL WORLD:

The very interesting and capable article on "Loaded High-Voltage Cables," by A. F. Puchstein, in your issue of April 7, is the first indication that I have seen from your side that the question of capacitance current in underground cables of high voltage, intended for the transmission of large power over long distances, has been seriously faced.

I have, of course, seen allusions to the question in discussions on the subject of high-tension transmission upon papers read before the American Institute of Electrical Engineers, but I have not seen it publicly stated that, if only we could get an underground high-tension cable comparable in cost with an overhead line, the advantages in the greatly reduced reactance of the line as compared with an overhead line would immediately secure exemption from the troubles of instability conferred upon overhead lines by virtue of their high reactance.

There is, I think, no doubt that the capacitance current in underground cables has been looming large in the minds of those who would like to propose the matter. Your contributor's article on the subject is therefore the more interesting.

His statement that no inductive coils—which might of course be used to nullify the capacitance current—have yet been developed which are suitable for the purpose is, I think, hardly fair to the General Electric Company, and he must have overlooked that in the *General Electric Review* for January, 1928, page 38, coils for this purpose were described.

His other suggestion, viz., the use of stepdown transformers to feed reactors or synchronous motors, does not appeal to me very much, but I think he cannot be aware of my American patent No. 1,638,647, which covers the idea not only of using stepdown transformers to feed reactors (for no-load periods), but, more particularly, to utilize that component of the current supplied by all existing town systems (through a number of which a high-tension trunk line may be assumed to pass in its course from the source of water power to the receiving end), which is at present the *bête noir* of the supply engineer.

If the supply busbars on an existing town's supply system are connected to the low-tension side of a stepdown transformer whose primary is connected to the high-tension transmission line we have automatically a compensatory current fed into the high-tension line which the local supply authorities would be only too glad to get rid of and which the transmission authority would be only too glad to pay for.

It may be mentioned that under the earlier arrangements contemplated by me (i.e., without the assistance of the above patent) the capacitance current will be only 25 per cent of that of any other system, per kilowatt transmitted, for equal-sized cables and equal temperature rise. That is, one can go to four times the distance, or, if operating under the above patent, one can do with one-quarter the number of feeding centers.

Slade Lodge, Erdington, Birmingham, England. A. M. TAYLOR.

Digest of Electrical Literature

Generation, Control, Switching and Protection

Improvements in Insulation for High-Voltage A.-C. Generators.—C. F. HILL.—The insulation problem as related to increased size, rating and voltages of turbo-alternators has been outlined, as have the results of experimental studies undertaken to determine the possibilities of improving the insulation of modern equipment. The effects of high-voltage testing and the use of hydrogen on the insulation problems precede an explanation of a device for the elimination of corona formed around armature coils. The author concludes that as generated voltages are increased it may become necessary to use higher voltage stresses in volts per mil thickness of the insulation, which, in turn, may necessitate the use of a lower power factor material in order that excessive heating may be avoided; that a decided improvement in the property just mentioned can be obtained for mica folium by a choice of bond containing only a negligible amount of a low loss solvent or other volatile material; that the reduction of the solvent decreases the tendency of such coils to expand, and that it has been found that the swelling is reduced to a small fraction of that of older types of insulation; that the factor of safety is considerably more than is ordinarily accepted as necessary for most applications, and that it may be desirable to eliminate corona at present voltages as well as at higher voltages.—*Journal of the American Institute of Electrical Engineers,* July, 1928.

Hydro-Electric Development and Steam Equipment

Stokers and Furnaces.—The principal contemporary development in stoker equipment and furnaces lies in the application of automatic and combustion control. Most new installations incorporate this feature, while many of the older installations are being provided with full or partial automatic combustion control. Data from a number of companies are included in this report and the results obtained indicate the utility and value of the system. Manufacturers' statements have been included. Stoker capacities are growing to meet the increased demand of heat liberation per square foot of available space, and in the design of the newer stoker models much attention is given to the regulation of air to various parts of the fuel bed. Interesting data on air requirements at various combustion rates are included. Several statements covering operating difficulties encountered with large stokers and the means employed to surmount these difficulties, as well as a considerable quantity of maintenance cost data, have been presented. Other topics treated include air preheater methods, frequency and cost of cleaning and comparative costs on several types of preheaters; considerations of water-cooled furnace walls, transfer curves, information regarding bare cast-iron blocks and refractory-faced cast-iron blocks.—*Serial Report National Electric Light Association,* June, 1928.

Thirty-three-Ton Hydraulic Coal Hoist.—A hydraulic hoist capable of lifting cars with a gross weight of 33 tons at a lifting speed of 50 ft. per minute with a hydraulic pressure of approximately 700 lb. per square inch in the main has been installed at an English quay. The lifting machinery consists of two hydraulic cylinders fitted with rams, crosshead, guides and sheaves with a multiplying power of two to one. The two rams are connected to the crosshead, which is fitted with four sheaves for the lifting rope. Four conveyance sheaves are also arranged on the top frame. The weight of the cradle is partially balanced and the amount of water pressure required is minimized by the use of a cast-iron counterweight attached to the crossheads. The lifting machinery is carried on vertical steel girders secured in the back of the framing.—*Engineer (England),* June 22, 1928.

Transmission, Substations and Distribution

Mercury-Arc Rectifier Substations.—GEORGE E. WOOD.—The direct-current railway supply for the street railways in the vicinity of Bridgeport, Conn., supplied by the Connecticut Company, is now obtained entirely through mercury-arc rectifier equipment. The author has outlined the system layout, the equipment used for rectifying purposes and the operating experience secured in the past few months. Two types of equipment are used, one station being arranged for manual control, while another is equipped for fully automatic operation.—*Report American Institute of Electrical Engineers,* May, 1928.

Connecting Small Apparatus to Large Transmission Systems.—F. RUTGERS.—Highly destructive action may take place when a short circuit occurs in a small transformer connected to a large high-voltage transmission system. An automatic oil circuit breaker or a set of fuses is either an inadequate protection against this emergency or else such a high rupturing capacity must be provided as to bring the cost out of proportion to the protected piece of apparatus. The author suggests for these purposes, small, solidly built air core reactance coils, which are placed before the small transformer. With such equipment, it is then possible to dispense with a circuit breaker and use a fuse. Oscillographic investigations of the performance of such an arrangement under dead metallic short circuits indicated the quick and harmless clearing. Difficulties are experienced when potential transformers are to be connected to a power system. As a new solution the author offers small horn gap switches, which are actuated automatically by the heat expansion of a series resistance rod.—*Bulletin de l'Association Suisse des Electriciens,* June 7, 1928.

Motors and Control

Automatic Operation of Pumps.—F. JOHNSTONE TAYLOR.—The technical requirements and advantages as well as the potential saving in attendance charges and the further possibilities of remote control in the application of automatic operation for pumps have been covered by the author. A number of control plans and arrangements have been reviewed and suggestions for improved operation and results offered.—*Electrician (England),* June 29, 1928.

Electrophysics, Electrochemistry and Batteries

Influence of the Cathode on the Electrodeposition of Chromium.—HIRAM S. LUKENS.—The production of passive nickel by electrodeposition is reported by the author. The influence of passive nickel, of active nickel, copper and lead on the composition of solutions for the electrodeposition of chromium has been studied and the results discussed, with particular reference to the speed of the plating operation. Means for correcting the chromic salt and sulphuric acid content of the solutions for the deposition of chromium are indicated.—*Report American Electrochemical Society,* April, 1928.

Gas-Filled Thermionic Tubes—ALBERT W. HULL.—A method of operating thermionic tubes containing low pressure gas, which avoids disintegration of the cathode, and of a new type of cathode which requires much less heat energy than any hitherto used, are described in this article. It is stated by the author that with these improvements hot cathode gas tubes appear to be practical, and their fundamental characteristics as lamps, rectifiers and thyratrons have been described. Disintegration voltages, heat-insulated cathodes, hot cathode lamps, hot cathode gas rectifiers and thyratrons are included in the discussion. The latter, which serves to control the arc by means of a grid, are said to require the following characteristics: The maximum filament voltage must not exceed the ionization potential unless the filament acts as a heater only and is wholly inclosed; the grid must not emit electrons; the grid must shield the whole cathode from the anode; the gas pressure must not be so high that

the positive ions persist for a half cycle; a full-wave hot cathode thyratron with two anodes in the same bulb will give large positive ion currents to the grids unless sufficient shielding is provided, and the tubes containing vapors which are ionized by contact with the cathode give positive ion sheaths around the grid when the grid is negative, making operation as thyratrons difficult or impossible.—*Report American Institute of Electrical Engineers,* May, 1928.

Rapid Dry Cell Testing.—J. G. ZIMMERMAN.—Empirical equations have been developed showing the relation of current to time at constant current discharge, average currents to time at fixed resistance discharge and resistance to time at fixed resistance discharge for dry cells. The author shows how it is possible to carry out one rapid discharge on a dry cell and from ensuing data predict the performance of other sizes of cells under a variety of discharge conditions, thereby eliminating a large number of discharge tests. Among the conclusions derived are: The average voltages obtained for all ranges of constant current or constant resistance discharge within reasonable limits are a linear function of the discharge rates; the discharge performances of different size cells made under comparable conditions may be calculated from one or two tests made at a relatively high current discharge rate without the time and labor of actual testing for other values; the available energy in a dry cell is a direct function of the mix weight; within limits the ampere-hour output of a dry cell on constant current discharge varies inversely as the current drain and the time of discharge varies inversely as the square of the current drain.—*Report American Electrochemical Society,* April, 1928.

Heat Applications and Material Handling

Probe Measurements in the Normal Electric Arc.—W. B. NOTTINGHAM.—Probe measurements have been made in cadmium, thallium and carbon arcs by sweeping the probe through the arc at a constant velocity and measuring the current collected by the throw on a ballistic galvanometer with different probe potentials applied. The voltage-current characteristic was analyzed to get a measure of the positive ion concentration, the average electron temperature and the space potential as determined by the Langmuir method. The various values obtained as a result of the determination have been given by the author. Over parts of the arc stream where the fields were found to be large the electrons showed corresponding increases in average temperature and evidence that only about three-quarters of the energy gained by the electrons from the field between collisions is lost by the electrons, while the remaining quarter is retained and made evident by the steady increase in the electron temperature. As the current flowing through the arc was increased, the radiation per unit volume and also the positive ion current per unit length of the probe were found to increase rapidly, indicating an increase in the efficiency of the ionization process as the current increases. It is thought that this observation is closely related to the fact that the voltage drop across the arc decreases as the arc current increases.—*Journal of the Franklin Institute,* July, 1928.

Units, Measurements and Instruments

Stability of Synchronous Motors Under Variable-Torque Loads as Determined by the Recording Product Integraph.—LEO TEPLOW.—The development of methods of calculation which may be applied directly to the widespread and increasing use of synchronous motors for driving certain loads has led to the present investigation of the several types of phenomena involved. The author has utilized a large compressor installation as an illustrative example. Expositions of the use of the integraph and the method of securing a solution by its use have preceded a brief discussion of the errors involved and the assumptions that must be made.—*General Electric Review,* July, 1928.

Telegraphy, Telephony, Radio and Signals

The Planning of Telephone Exchange Plants.—W. B. STEPHENSON. The procedures followed in planning future extensions to telephone exchange plants to take care of increase demand for telephone service have been given. An outline of the methods employed in forecasting future demand for service and in determining the most efficient design of the plant to meet future requirements is also offered. Engineering comparisons have been utilized in solving the economic phases of various kinds of telephone engineering problems and with particular reference devoted to location and size or extent of major items of plant as well as the time when they should be ready to give service. The importance of the factors not readily evaluated such as service factors, practicability from a construction and operating standpoint, flexibility and similar considerations are likewise pointed out.—*Journal of the American Institute of Electrical Engineers,* July, 1928.

Traction

Suburban Railway Electrification.—M. G. SAY and S. PARKER SMITH.—This first of a series of articles deals descriptively and critically with the more important suburban railway electrifications throughout the world, particularly those of interest on account of their size. The first installment covers the limiting features of the nose-suspension drive as related to gearing, wheel diameter and track gage. Among the advantages of suburban electrification which are recognized by the authors are: Multiple-unit operation allowing a service of almost constant frequency throughout the day with seating capacity that can be varied according to traffic requirements; rapid acceleration obtainable because of the inherent overload capacity of the motors supplied from a large power station; the high coefficient of adhesion; the distribution of adhesive weight and the uniformity of starting effort; terminal capacity is increased due to the elimination of "running round" and better utilization of rolling stock; fuel economy realized due to the absence of stand-by losses and more efficient combustion of inferior coal in the power station; simplified maintenance; eliminated smoke nuisances and the elimination of the problems of railway supply coal. The authors have offered a technical discussion of the more involved features of such service.—*World Power,* June, 1928.

Miscellaneous

A Theory of Lightning.—CHARLES LE G. FORTESCUE.—In this first of a series of articles the author presents data regarding lightning phenomena obtained as a result of investigation by himself and by contemporary research workers in the same field. It is concluded as the result of klydonograph studies carried on over a period of years that surges due to switching and other operations are of negligible importance and very rarely cause other disturbances or result in breakdown of apparatus; the surges that do cause trouble, such as spillover of insulators or failure of apparatus, and which are likely to result in serious outages, are all caused by lightning. A transmission line on account of its high relative capacity need not, according to the author, absorb the full energy of a stroke of lightning, but simply transmits it in the form of a surge. If the current density in the surge path of the lightning stroke is not sufficient to fuse the conductors, there is no reason, recognized by the author, why a direct stroke should not pass into the line and produce a high negative traveling wave.—*Electric Journal,* May, 1928.

Competitive Purchasing and Evaluation of Proposals for Power-Plant Equipment.—L. B. BONNETT. — A description of the procedure employed by the Brooklyn Edison Company is offered by the author as one which encourages manufacturers to propose the best equipment they know how to build. It is clearly indicated that excellence of performance has a definite and recognized value to the company and stimulates the proposing of improved designs as soon as they are available. Further, it is assumed to result in the fairest judgment of the merits of different proposals and therefore in the purchase of the most satisfactory equipment for the physical conditions which have to be met.—*Mechanical Engineering,* July, 1928.

News of the Industry

Federal Trade Investigation Enters Second Phase

The Federal Trade Commission now is actively at work on the second phase of its public utilities investigations. Twenty-six of its representatives are busy taking pertinent information from the books of a number of the large holding companies. The remaining phases of the inquiry, the commission says, call for a high degree of specialized knowledge and experience. The staff of the commission has been augmented by a number of accountants with experience with state utility commissions.

Of the 10,211 questionnaires sent out at the beginning of the investigation to the privately owned utilities, 5,944 returns have been received. It has been learned, however, that a considerable number of the companies originally addressed have retired from business or have been absorbed by other companies or are not public utilities. It is estimated that less than 2,000 companies actively engaged in the utility business are still to be heard from.

Another lengthy and intricate questionnaire will be sent to the utility companies about Aug. 1.

Edison Association to Meet at Old Point Comfort

The 44th annual meeting of the Association of Edison Illuminating Companies will be held at the Chamberlin-Vanderbilt Hotel, Old Point Comfort, Va., Oct. 1 to 5, 1928. Attendance is restricted to accredited delegates of member companies and to guests who are officially invited by the president and the executive committee. An endeavor is being made to limit the program to presentations of major concern and to reserve ample time for discussions from the floor. Details will be supplied to members later.

It is probable that special trains will be operated from Chicago and from New York. As some delegates may wish to take advantage of the opportunity for a one-day ocean voyage, provision will be made to secure best available accommodations on the Old Dominion Line steamers.

No Parallel Sessions and Fewer Topics Next Year

The fifty-second convention and exhibition of the National Electric Light Association will be held in Atlantic City, N. J., from Monday to Friday, inclusive, June 3 to 7, 1929. The convention and exhibition will be housed in the municipal auditorium now under construction. President Arkwright has already given considerable thought to the 1929 program. The tentative plans are outlined below:

It is proposed to hold four general sessions, one each on the mornings of Tuesday, Wednesday, Thursday and Friday. At these sessions no committee reports are to be presented. Most of the committees have adopted the serial rather than the convention form of report. Topics of outstanding interest will be presented. A lesser number of items will be scheduled per session than heretofore.

Each of the four national sections will hold a session, these being distributed over three afternoons rather than confined to one afternoon as heretofore. For example: Tuesday afternoon, Accounting and Commercial National Sections; Wednesday afternoon, Engineering National Section; Thursday afternoon, Public Relations National Section.

The public policy committee session will be held on the evening of Thursday instead of Wednesday, as has been the case the last two or three conventions.

High-Tension Link Completed in Chicago Area

The final link in the network of high-voltage lines connecting Keokuk, Springfield and Chicago territory was finished last week when the Public Service Company of Northern Illinois completed its 132,000-volt line between Joliet and Seneca, Ill. This will tie in the Powertown station, near Peoria, which will have two 52,500-kw. generating units in operation soon. The Joliet-Seneca line is along a right-of-way which officials say may eventually be utilized for an electric freight line as well. At Seneca the Public Service line connects with the Illinois Power & Light Company's system, having a 66,000-volt connection with Keokuk, Iowa.

Northwest England Reorganizes Systems

Twenty-seven Out of 70 Generating Stations to Be Permanently Operated in Interconnection—Close to 2,000,000 Kw. Is Expected by 1941 and Output of 5,813,000,000 Kw.-Hr.

ENGLAND'S Central Electricity Supply Board has announced details for the reorganization and expansion of electric power supply in the northwest England district, according to Assistant Commercial Attaché Hugh D. Butler, London. This district embraces four very important manufacturing areas in the Lancashire district.

Of these areas, southeast Lancashire is responsible for about 70 per cent of the total present production of electrical energy in the district. There are six highly efficient stations in southeast Lancashire. The work of the reorganization of electrical output there has already been practically completed. The principal work which remains to be done is to connect up the whole of northwest England by main transmission lines supplementing those already in existence, running from Carlisle on the north to the edge of Cheshire district on the south, where connection will be made with the central England lines, a total of 384 miles in all, at a cost of £4,829,000. It is estimated that in the next twelve years there will be expended in this district a total of about £40,000,000 in all, to cover transmission lines, secondary distribution, power plant, etc.

The new scheme proposes that throughout the northwest England district of the 70 generating stations now owned by 122 authorized undertakers, 27 have been selected for permanent operation and six for temporary operation. In addition, the North Wales Power Company, which has already completed its own main transmission system in such a way that it can be fitted into the new scheme satisfactorily, has two water-power plants which will be added to the list of selected stations.

The total capacity of plants installed or sanctioned in the northwest England district is 1,227,974 kw. New plants and extensions by 1940-41 will bring up the total to 1,991,125 kw., with a total output estimated to rise to 5,813,000,000 kw.-hr., with an estimated output per head of population of 686 kw.-hr. per annum.

The present price at which energy is sold in the district averages 1.34 pence per kilowatt-hour. The estimated cost under the scheme is expected to fall from 0.424 pence in 1931 to 0.377 pence in 1935.

Preliminary Work on Lackawanna Electrification

Preliminary to electrifying the Lackawanna Railroad engineers are working on surveys and other necessary details, according to John M. Davis, president of the railroad.

"They have been at work for some time," he said, "making surveys in connection with the installation of electricity, measuring clearances for bridges,

tunnels and other structures—even the train shed of the Hoboken Terminal will have to be altered to accommodate the new installation, preliminary studies to determine capacity and character of motors best suited to the requirements of this particular service, the most satisfactory methods of supplying and applying electric power for train operation and many other important angles of this job.

"This work must be done before the railroad can intelligently ask for bids on materials and construction, and until materials are unloaded along the right-of-way and actual construction work is commenced no actual evidence of progress will be visible to patrons and the public generally."

$85,000,000 Hydro Project on Dnieper River

Col. Hugh L. Cooper, who has been engaged as consulting engineer for the Soviet Government on the $85,000,000 Dnieper River power project, sailed Saturday for Moscow. According to Colonel Cooper, the dam in the Ukraine will be 20 per cent bigger than the Nile Dam. Turbines rated at 80,000 hp. each will be used and will be required to operate under a 116-ft. head. Locks will be involved to permit navigation.

During the last year the Soviet authorities purchased in the United States for the Dnieper River project construction equipment costing more than $1,500,000; $18,000,000 will be spent eventually for construction and permanent equipment.

The total cost of the Dnieper River power and navigation installations, according to Colonel Cooper, is estimated at $85,000,000, of which about $20,000,000 has already been expended. Approximately 8,500 men are employed on the project and the plant is expected to be completed by 1932. The dam and navigation facilities, he said, will be by far the largest in the world.

Upper Roanoke River to Be Developed

Connecticut River Plant to Be Ready in Fall—Chippewa Falls Completed—Small Remote-Controlled Plants on Kentucky River Planned

TWO large hydro developments to cost almost $14,000,000 are contemplated on the Roanoke River between Clarksville, Va., and Roanoke Rapids, N. C. The 100-ft. fall in this river within the bounds of Virginia will be backed by two dams to produce 130,000 hp., when plans of the Virginia-Carolina Power Company are completed.

The greatest of the valley developments, if plans go through, will be the Bugg's Island project of the Roanoke River Power Company. One million dollars has already been spent in buying up approximately 15,000 acres of land, over which water will be backed by a 55-ft. dam for a distance of 20 miles to Clarksville, Va. The entire development will cost approximately $10,000,000. The effective storage will hold 5,000,000,000 cu.ft. of water.

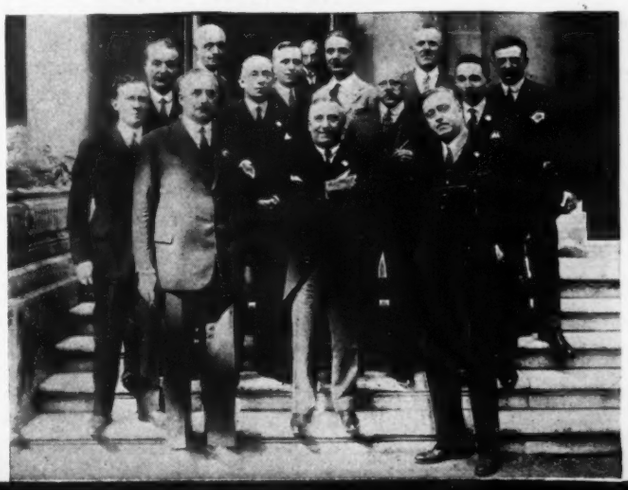
The company is ready to start work at once on the Bugg's Island dam. From ten to fourteen months will be required to put the dam and power house in operation. The plant will have an installed capacity of 80,000 hp. Viele, Blackwell & Buck of New York are the engineers for this plant, as well as for the larger development of the Virginia-Carolina Power Company.

The New England Power Association's $4,000,000 power development in the Connecticut River at Bellows Falls will be completed in September, according to an official of the company. This development will provide 60,000 additional horsepower to be sold in New Hampshire, Vermont and other states.

The Kentucky Utilities Company has petitioned the Federal Power Commission for permits to construct two more power plants on the Kentucky River at a cost of about $600,000 each. It is planned to install low-head plants of about 2,500 hp. each below Frankfort and between High Bridge and Tyrone, to be operated by remote control from the Dix River plant. Each would be constructed on high concrete piers out of reach of floods and contain three generators.

The new Chippewa Falls, Wis., plant of the Northern States Power Company, completed two months ahead of schedule, adds 30,000 hp. to the company's system in Wisconsin and Minnesota. It is equipped with six 3,600-kw. generators and operates under

International Congress of Producers and Distributors



The Italian delegation, with Giau Ponti, Turin, Italy, president of the Union Internationale des Producteurs et Distributeurs de l'Energie Electrique, in the center, is shown in the small group. The congress met in Paris July 5-10, 1928.

a 30-ft. head. The plant was designed and built by the Byllesby Engineering & Management Corporation for the Northern States Power Company, which already has twelve power plants in operation.

Stone & Webster Expand

The construction and engineering business of Stone & Webster, Inc., Boston, Mass., and the interests of this house in Ulen & Company, New York City, have been taken over by the Stone & Webster Engineering Corporation, a newly formed organization with a capitalization of $9,500,000. The Stone & Webster Engineering Corporation has also acquired from the North American Company its engineering and construction company known as McClellan & Junkersfeld, Inc. G. O. Muhlfeld is president of the new company.

Opposes Municipal Plants Serving Outside Territory

The Missouri Power & Light Company, which operates in about 95 Missouri towns, in a motion filed with the Missouri Public Service Commission July 21 has attacked the constitutionality of a statute which permits Missouri municipalities owning electric plants to supply power to other cities and towns and to build the necessary transmission lines for the furnishing of this out-of-town service.

On July 18 the Missouri commission authorized the city of Columbia to build a transmission line from its municipal power plant to Ashland, Mo., 15 miles south of Columbia, and to furnish electric current to Ashland. Prior to the ruling of the state commission the Missouri Power & Light Company had filed an intervening petition and contends it should have been given reasonable time in which to obtain a franchise from Ashland to furnish it with electric service.

The grounds for attacking the constitutionality of the law under which the commission has authorized the extension of municipal service are that it enables a city to use public funds for purposes outside the city's limits and also enables the making of ciay appropriations for the use of another municipal corporation. After the commission authorized the construction of the line to Ashland the project was held up by injunction proceedings brought by a taxpayer of Columbia.

Seeks Further Reductions in St. Louis Rates

An audit of the books and records of the Union Electric Light & Power Company of St. Louis, Mo., by the Missouri Public Service Commission to determine whether a further reduction in the light and power rates of the company is justified will be started by the commission within the next ten days. The audit, which will extend back to 1915, when the commission made its last check of the company, will require about a year to complete.

The company is claiming a valuation of $59,000,000, compared with the $26,000,000 rate-base value fixed by the commission in 1915.

The city of St. Louis requested the audit, declaring the company can reduce its rates a total of $1,400,000 a year and still earn a fair return on its property. In May the company voluntarily reduced the electric rates of large consumers $600,000 a year and cut its steam-heating rates about $100,000 a year. No reduction was made in residential rates in St. Louis.

Tennessee River Permit Issued by Commission

The Federal Power Commission at a meeting July 23, attended by Secretary Jardine and acting Secretary Finney, authorized the issuance of a preliminary permit to the Mississippi Power Company covering a proposed development on the Tennessee River at Cook's Landing. By creating an effective head of 41 ft. at that point a reservoir extending 63 miles up stream to the base of the Muscle Shoals dam would be created. This would flood out the existing government, lock, dam and canal at Colbert Shoals. The initial installation proposed is 100,000 hp., but plans provide for the ultimate installation of 260,000 hp. As the recent report of the engineers on the Tennessee River indicates that the interests of navigation would be served best by locating the dam at Pickwick Landing, 11 miles farther down stream, the preliminary permit contains a condition under which the power company must submit a complete engineering, economic and financial report on the Pickwick Landing site.

The termination of the license of the Alabama Power Company covering five units of its proposed further development of the Tallapoosa River was approved by the commission. The company asked for the cancellation of the license, as it does not consider the further development of the river as being justifiable at the present time.

Cincinnati-Indianapolis Tie-in

Notable Addition to Middle West High-Tension Routes Interconnects Union Gas & Electric Company and Indiana Electric Corporation

A NOTABLE addition to the high-tension transmission lines in the Middle West went into operation some weeks ago with the opening of a 132-kv. system from Cincinnati to Indianapolis. This is a one-way line designed to enable the Insull-owned Indiana Electric Corporation to purchase power from the Union Gas & Electric Company of Cincinnati. The line, which is about 80 miles in length, was built by the Indiana Electric Corporation with the exception of about a mile at the southeastern end stretching from the Ohio-Indiana border to the Columbia generating station of the Cincinnati company at Columbia Park, Ohio. Double-circuit, steel-tower construction has been used, the space between towers being about 1,000 ft. At present only one line has been installed. Overhead ground wire is installed throughout.

The 132-kv. line from the Columbia generating station to the Lenore substation, near Indianapolis, is supplied by a 30,000-kva. transformer bank at Columbia. Lenore is the large substation of the Indiana company just south of Indianapolis. The conductors are 397,500-circ.mil A.C.S.R. At Lenore the line is tied in with the two 132-kv. lines which run from there to the Dresser generating station, near Terre Haute, Ind., thus forming a triangular high-tension interconnection. The amount of power available from Columbia, which ranks as one of the best designed and most efficient generating stations in the United States, can be increased when the demand necessitates. Up to the present a peak load of 17,000 kw. has been transmitted. The route from Columbia Park to Lenore is through Lawrenceburg, Greensburg and Shelbyville, Ind.

Boulder Dam Board Limited on Scope

Under the terms of the Senate resolution, no expressed authority is given the Boulder Dam board to do more than to examine the proposed site of the dam and to review the plans and estimates made for that particular development. The board is called upon for advice as to the "safety, economic and engineering feasibility and adequacy of the proposed structure and incidental works." It is doubted at the Department of the Interior if this includes the all-American canal or other matters that are not directly a part of the project planned at the dam site. It is recognized, however, that reports made under congressional resolutions frequently are much broader than are warranted by the specific language used.

On the other hand, the commission must submit its completed report by Dec. 1. Because of the short time for the study, it is expected that the board will be anxious to confine the report to the narrowest limits possible. It is not believed that any attempt will be made to deal with general problems pertaining to the Colorado River.

Members of the board will hold their first conference in Washington July 30.

Purchases and Mergers

Southeastern Power & Light Absorbs Augusta-Aiken Railway & Electric and Georgia-Carolina Power Companies—Several Small Purchases

MERGER of the Augusta-Aiken Railway & Electric Corporation and the Georgia-Carolina Power Company with the Southeastern Power & Light Company has been completed. The two companies were managed and operated by the J. G. White Management Corporation and owned the Augusta street railway system, the Augusta-Aiken interurban system, the Georgia-Carolina power plant on the Savannah River and electric light plants in approximately 40 Georgia towns, in addition to several South Carolina towns.

No announcement was made as to the purchase price of the properties. Minority preferred-stock holders have been offered an exchange of Southeastern Power & Light Company preferred stock for their holdings in the two companies and the property will be closely co-ordinated with the Georgia Power Company and its subsidiaries, it is expected.

Three municipal plants in Nebraska have passed during the last two weeks into the hands of high-line companies. The Elkhorn Valley Power Company of Scribner has purchased the town plant at Creston, subject to approval of voters at a special election; the Nebraska Electric Power Company has taken over the distribution system of the town of Brule, and the Nebraska Power Company the distribution system at Cedar Bluffs. Substantial reductions in rates are to follow in each village.

The Iowa Railway & Light Corporation last week purchased the distribution system of the Farlin Power & Light Corporation. A new distribution system will be built and the high line rebuilt. Residents have been promised a 40 per cent rate reduction.

The Pacific Gas & Electric Company has been authorized by the California Railroad Commission to purchase the Vacaville Water & Power Company for the sum of $165,374.

The Central Illinois Public Service Company has made a cash offer of $150,000 for the Shelbyville, Ill., electric service system with a 20-year franchise.

By an agreement reached between the Holyoke Water Power Company and the gas and electric department of the city of Holyoke the city will purchase energy produced from surplus water power of the company, enabling the municipal department to cut its consumption of coal by some 8,000 tons a year and involving a money saving to the city of $15,000 a year or more.

International Fuel Conference

Seven of the ten official delegates who will represent the United States at the Fuel Conference to be held in London, Sept. 24 to Oct. 6, under the auspices of the World Power Conference, have been chosen, as follows: Dr. Gustav Egloff, petroleum technologist Universal Oil Products Company, Chicago, Ill.; H. W. Brooks, consulting engineer, New York City, representing the American Society of Mechanical Engineers and the International Railway Fuel Association; O. P. Hood, chief of the technological branch, U. S. Bureau of Mines, Washington, D. C., representing the American Society of Mechanical Engineers; Martin Frisch, manager of field engineering Combustion Engineering Corporation, New York City; G. A. Orrok, consulting engineer, New York City, representing the American Society of Mechanical Engineers; David B. Rushmore, formerly consulting engineer General Electric Company, New York City, member of executive committee American committee, and O. C. Merrill, general chairman of the American committee of the World Power Conference, ex-secretary of the Federal Power Commission.

Among the papers to be presented by Americans are the following, classified by associations represented:

American Institute of Mining and Metallurgical Engineers.—"Pulverized Fuel for Steam Purposes," Martin Frisch and Henry Kreisinger, Combustion Engineering Corporation, New York City; "Pulverized Fuel in Metallurgical Work," W. O. Renkin, Fuller-Lehigh Company, Fullerton, Pa.; "Pulverized Fuel in Marine Works," H. W. Brooks, consulting engineer, New York City.

National Electric Light Association.—"Domestic Heating by Means of Solid Fuel, Oil, Gas and Electricity," H. W. Derry, Union Gas & Electric Company, Cincinnati, Ohio; "Utilization of Electricity for Industrial Heating," W. H. Sammis, Consumers Power Company, Jackson, Mich.

American Institute of Electrical Engineers.—"Utilization of Electricity for Industrial Heating."

U. S. Bureau of Mines.—"Coal Classifications," A. C. Fieldner, Washington, D. C.

More Inducement Rates Adopted

Utica, Syracuse and Other Utilities Companies Install Inducement Rates to Stimulate Domestic Business—Several Important Rate Reductions

TWO important announcements were made this week with regard to the introduction of inducement rates designed to increase the domestic use of electricity. The major companies concerned are the Utica Gas & Electric Company and the Syracuse Lighting Company, both subsidiaries of the Mohawk-Hudson Power Corporation. In both cases substantial reduction is made in the unit cost of energy over a specified minimum.

Utica and Syracuse Changes

The Utica company's new schedule is applicable to the suburban territory around Utica, including the Kirkland and Newport districts, and becomes effective Aug. 16. It covers both residential and commercial usage. The object of the change, which is now before the Public Service Commission, is to encourage the use of electricity in larger quantities by decreasing the rate for additional usage, such as electric cooking. The new rate follows:

Residential (for all residential uses on one meter).—$1 per month, plus 6½ cents per kilowatt-hour for first 40 kw.-hr. per month; 3½ cents per kilowatt for all over 40 kw.-hr. per month. Minimum charges: One dollar per month unless modified by the company's line extension plan.

The new domestic rate for Syracuse applies chiefly to customers with a connected load of 4 kw. or greater. For the first 50 kw.-hr. per month the unit cost is 8 cents per kilowatt-hour and for amounts in excess thereof the charge is 3 cents per kilowatt-hour. Each subscriber to the new plan must contract for a year's service with a minimum charge of $4 a month.

Under the previous rates a customer using 300 kw.-hr. a year would pay $17, whereas the same amount of energy can be secured under the special domestic rate for $11.50.

Several other reductions in power and light rates were announced during the week. The New Hampshire Public Service Commission has approved new rates for the Hillsborough-Henniker and the Antrim-Bennington divisions of the New Hampshire Power Company. Reductions in the former division will save customers $2,500 in the aggregate and reductions in the latter will save customers $2,200 a year in the aggregate.

The Gulf States Utilities Company announces a reduction in the cost of electric service, from 20 cents per kw.-hr. to 15 cents. A general reduction in power rates is announced also for Chestertown, Md. Several reductions in New England were announced this week on the part of the Cumberland County Light & Power Company and the Grafton Power Company, a subsidiary of the New England Power Association.

A standardized schedule involving several rate reductions has been promised by the Emmitsburg Electric Company within 30 days and reductions are announced in the case of the Arkansas Power & Light Company.

Paris-Versailles Line Electrified

Electrification of the old steam line connecting Paris, Saint-Lazare and Versailles is now nearing completion, according to Trade Commissioner Louis Hall, Paris. This brings the total electrified mileage operated by the Chemins de Fer de l'Etat to 56 miles and the total daily number of electric train-miles to 9,321.

The new electric line will increase the number of electric trains leaving Gare Saint-Lazare each day from 450 to about 700.

Organizing to Guard Schools from Propaganda

National Educational Association Forms Board to Determine Method of Protecting Schools—Secretary Reports that Industry Leaders Welcome Standards

APPOINTMENT of the board of ten educators authorized at the recent annual meeting of the National Educational Association to fix upon a definite method of dealing with the dissemination of publicity material in the schools and colleges is expected in the near future, when Dr. Uel W. Lamkin, president of the association, confers with officials at the headquarters of his organization in Washington. At its recent convention the association passed a resolution calling upon its president to name such a board. Dr. Lamkin, who is also president of the Teachers' College of Missouri, has let it be known that it will not be the purpose of this board to engage in any investigational work.

Dr. J. W. Crabtree, secretary of the National Educational Association, expressed confidence that the industries themselves are about to set up definite standards of their own governing such activities. One of the most important points that the board of educators will have to consider, Dr. Crabtree indicated, will be the determination of the best means of instituting and directing university courses in utility work. Following is Dr. Crabtree's complete statement:

"We are not in this matter of dealing with publicity material to injure anybody or any industry, but merely to prevent the schools from being injured. Nor are we seeking to find out what harm certain industries may have done, or to fasten the blame on any agency. There are other organizations to do these things. What we want to do is to work out some principles of administration to guide teachers in handling all material, including that which may be classed as propaganda. We want to have some sort of machinery set up to act on a local, state, or national basis to serve as a protection to teachers and school officials.

"I think that there are evidences that the power organizations are taking hold of these questions themselves. A number of the leaders of the industry have expressed the opinion that they should have definite standards relating to propaganda. If they do so it will mean that other commercial organizations will follow suit."

Preliminary Work Authorized for Slave Falls Project

Original plans for development of the Slave Falls site on the Winnipeg River were on the basis of 65,000 hp. These have now been amended for an additional 35,000 hp. An additional 35,000 hp. to be developed at the Pointe du Bois plant, which is now producing 105,000 hp., was anticipated by J. G. Glassco, general manager Winnipeg Hydro Electric System, in asking the public utilities committee of the City Council for authorization to expend $20,000 for layout work preliminary to the proposed Slave Falls development. The Slave Falls proposition, he said, has changed from a $6,500,000 project to one which will involve from $9,000,000 to $10,000,000. Authorization to proceed with the preliminary work was given.

With the 70,000 additional horsepower mentioned by Mr. Glassco, the city of Winnipeg will eventually have in the neighborhood of 240,000 hp. of hydro-electric power from its two sites on the Winnipeg River. Besides the 105,000 hp. of installed capacity at the city's Pointe du Bois plant, other installations on the Winnipeg River are the 112,000-hp. installation of the Manitoba Power Company at Great Falls, which is to be increased to 192,000 hp. by the installation of two additional units, and the Winnipeg Electric Company's development of 37,800 hp. on the Pinawa Channel. Six of the nine power sites on the Winnipeg River in the province of Manitoba are still in the undeveloped stage.

The total power available along this reach of the river is estimated to exceed 500,000 hp. and the power possibilities have lately been improved through the decision to proceed immediately with the erection of a storage dam at Lower Ear Falls below Lac Seul in the province of Ontario, this control work having been arranged between the Manitoba, Ontario and Dominion governments.

English Railroad Electrification and Lamp Markings

Suburban Electrification Approaching Completion to Cost £11,500,000—Oil-Electric Locomotives in Another Case —Origin of Imported Lamps Must Be Marked

By Bernard C. Holding
Editor "The Electrician," London

SOME interesting work has been accomplished during the past year at the National Physical Laboratory. The annual report of the institution discloses, among other things, that the 1,000,000-volt transformers are nearly completed and that the necessary apparatus is under construction for the determination of the ohm (absolute) in terms of mutual inductance and frequency by the alternating-current method devised by Albert Campbell.

Further suburban electric railway extensions recently opened by the Southern Railway Company bring a stage nearer to completion the electrification scheme, to cost £11,500,000, upon which the company embarked only a few years ago. When the change from overhead to third-rail working on certain of the old suburban lines is completed the total electrified route-miles on this railway will be 256, embodying 875 track-miles. It is estimated that the all-electric services will give an annual train mileage of about 7,750,000, which is equivalent to a 100 per cent increase in the case of present steam mileage and of 50 per cent in the present electrical mileage. When it is borne in mind that these developments have been made in face of severe competition from road traffic carrying passengers at uneconomic prices, the extent of the achievement will be better realized.

Another railway development which will be watched with interest is the oil-electric equipment which is being made by William Beardmore & Company and the English Electric Company for the London, Midland & Scottish Railway. With a power unit comprising an oil engine and an electric generator mounted at one end of the train, and controlled electrically from either end, the equipment is designed to meet the normal requirements of local passenger service on English railways, where trains of five or six coaches have a total weight up to 175 tons.

Following the inquiry held more than two months ago into the application made for the marking of imported electric lamps with some indication of origin, the standing committee under the merchandise marks act (1926) has now recommended "that imported electric incandescent lamps, except small lamps where the size of the bulb renders it impracticable to mark it in any way, should be required to bear an indelible indication of origin in a conspicuous manner. This indication is required on the bulb and also on any carton, wrapper or other container in which they may be imported, sold or exposed for sale. In the case of small lamps it will be sufficient if a conspicuous indication of origin is borne on the carton or other container. To avoid confusion the committee thinks it desirable that wireless valves and mercury-vapor lamps should be specifically excluded from the order.

The committee further considers that an exemption from the marking requirement ought to be provided in the case

of lamps imported with and forming part of other goods, e.g., lamps on a motor car or lamps imported in electric torches. The committee recommends that the order-in-council should come into force six months after the date on which it is made.

Canada Active on Hydro Plants

Chute-à-Caron Project to Occupy Three Years—Gatineau Power Augmented—Ontario Commission to Add 14,300 Hp.

GOOD progress is reported in connection with the gigantic hydro-electric development being undertaken at Chute-à-Caron, on the Saguenay River, Province of Quebec, by the Alcoa Power Company, subsidiary of the Aluminum Company of Canada, Ltd. A by-pass canal in the form of a U is being excavated around the proposed site of the dam, so that the river can be diverted. With this completed, pouring of concrete and general construction can go ahead. The turbines will operate under a head of approximately 150 ft. and the initial development will have an output of about 250,000 hp. This development will ultimately produce 800,000 hp.

At the present time there are about 900 men working on the preliminary operations. It is believed that it will take three years to complete the first stage of this development.

With the fourth of six proposed 34,000-hp. generators now in operation, the Paugan Falls power plant of the Gatineau Power Company, on the Gatineau River, in Quebec, has a total of 136,000 hp. available. A fifth generator is to be installed in the near future, bringing the rating up to 170,000 hp. The Paugan Falls plant is to be interconnected with all the other plants of the Gatineau Power Company, so that the company will have a connected distribution of nearly three-quarters of a million horsepower.

Engineers of the Ontario Hydro Electric Power Commission are now undertaking the preliminary work in connection with the projected launching next year of two new developments within the Georgian Bay system. From one of these developments, to be located on the Muskosh River, 12,000 hp. will be made available. Materials necessary for this plant are now being ordered. The second development will be on the South River, below Huntsville. It will add 2,300 hp. to the 6,650 hp. which is the combined generating capacity of the two old developments.

NIAGARA FALLS POWER COMPANY GIVES LAND FOR PARK.—The Niagara Falls Power Company has transferred 58 acres of land at Niagara Falls to the city to be used for park purposes. The company has also given to the city a strip of land, 100 ft. wide and 4,000 ft. long, for the extension and widening of Porter Road.

Briefer News

KENTUCKY TO INVESTIGATE UTILITIES.—Lieut.-Gov. James Breathitt, Jr., of Kentucky has announced appointment of a committee for the investigation of the public utility situation in Kentucky, as called for by a resolution adopted at the last session of the Kentucky Legislature. State Senator T. O. Turner, Frank Dacher, J. K. Waller, E. A. Pollard and Mr. Breathitt will serve on the committee.

PROGRESS OF CHELAN (WASH.) DEVELOPMENT.—An agreement providing that each company will build part of the 110-kv. transmission line between the Chelan power station of the Washington Water Power Company and the town of Wenatchee, Wash., on the lines of the Puget Sound Power & Light Company, has been announced by the two power companies. The line will be about 40 miles long and the survey work is complete. The Washington Water Power Company's second unit of 32,200 hp. is ready to go on the line.

SAFETY CONGRESS WILL MEET IN NEW YORK IN OCTOBER.—The National Safety Council, of which the Public Utilities Section is by far the largest active division, will hold its annual safety congress in New York City Oct. 1 to 5. The Public Utilities Section meetings will be in the Hotel Pennsylvania, beginning Oct. 2.

TRANSMISSION-LINE EXTENSIONS IN INDIANA.—Power has been sent through the new 33,000-volt, 35-mile line of the Indiana General Service Company between Marion and Muncie, Ind. The voltage will be raised to 132,000 on the completion of a substation at Marion, and plans are being made to extend the line about 40 miles west from Marion to Kokomo. An aërial survey has been made.

MOUNTAINOUS STRETCH OF RAILROAD IN MEXICO ELECTRIFIED.—Electrification of an additional stretch of the mountainous section of the Mexican Railway connecting the port of Vera Cruz with Mexico City has been completed, acting Commercial Attaché George Wythe, Mexico City, advises the Department of Commerce. The new stretch of electrified road is between Cordova and Paso del Macho. Together with previously completed sections, a total of 65 miles between Esperanza and Paso del Macho is now electrified. The grade is declared extremely steep. In the 65 miles between Paso del Macho and Esperanza the road rises from about 1,500 ft. to 8,000 ft. above sea level.

CHURCHILL RIVER IN SASKATCHEWAN TO SUPPLY POWER TO MINES.—The Flin Flon mining interests have definitely decided to develop the power necessary for their mining project in the Province of Saskatchewan, at Island Falls on the Churchill River, according to an announcement made by James Gardiner, Premier of the province. These falls are situated 15 miles west of the eastern boundary of Saskatchewan and near the point where the Churchill River flows out of Saskatchewan into Manitoba. It has been made a condition that one-sixth of all power developed shall be reserved for public use in the provinces. The development will mean an early expenditure of several millions of dollars.

HEARING ON PLANS FOR DEVELOPMENT OF THE NEW RIVER.—A hearing was held recently at Radford, Va., by Major E. D. Ardery, on the application of G. S. Howe to the Federal Power Commission for permission to dam New River at a point 1 mile below Whitehorn and 12 miles below Radford. Objections were made by the Norfolk & Western Railway, Virginian Railway, Electrometallurgical Company and Appalachian Power Company. W. J.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

National Electrical Manufacturers' Association — Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 5-7. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Maryland Utilities Association—Braddock Hotel, Braddock Heights, Md., Sept. 7. D. E. Kinnear, 1005 Continental Bldg., Baltimore.

Western Section, International Association of Electrical Inspectors—Cosmopolitan Hotel, Denver, Sept. 10-12. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Illuminating Engineering Society—Toronto, Can., Sept. 17-20. L. H. Graves, 29 West 39th St., New York.

Rocky Mountain District, N.E.L.A.—Hotel Colorado, Glenwood Springs, Sept. 17-20. (With Colorado Utilities Association.) O. A. Weller, Public Service Co. of Colorado, Denver.

Empire State Gas and Electric Association—Saranac Inn, Upper Saranac, N. Y., Sept. 20-21. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Cleveland, Sept. 22-28. J. W. Welsh, 292 Madison Avenue, New York.

International Committee on Illumination, Saranac Inn, Lake Saranac, N. Y. Sept. 22-28. (See Illuminating Engineering Society.)

New England Section, N.E.L.A.—Poland Springs House, South Poland Springs, Me., Sept. 24-27. Miss O. A. Bursiel, Statler Bldg., Boston.

Great Lakes Section, N.E.L.A.—French Lick Springs, Ind., Sept. 27-29. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Edison Illuminating Companies—Chamberlin-Vanderbilt Hotel, Old Point Comfort, Va., Oct. 1 to 5, 1928. Preston S. Millar, East End Ave. and 80th St., New York City.

Dermett, a rival applicant, said that within ten days he would file application to construct a dam 5 miles higher up the river which would be of less height and at the same time furnish more power. He did not divulge who is associated with him in the project.

IDAHO MUNICIPAL PLANT MUST HAVE FISH LADDER. — Building of a fish ladder at an estimated cost of $40,000 will be necessary if the city of Sandpoint, Idaho, constructs a proposed municipal power plant on the Priest River, R. E. Thomas, Idaho state game warden, has informed the municipal government. The City Council recently appropriated $4,000 for further investigation of the project.

LIEVRE RIVER, QUEBEC, MAY FURNISH 100,000 HP. FOR PAPER MANUFACTURE.—Important developments in the Lievre River district of Quebec, northeast of the city of Ottawa, are foreshadowed in the announcement that the Maclaren Lumber Company of Buckingham is considering the erection of a 250-ton pulp and paper mill at the mouth of the river. The mill will be served with electrical energy to be developed at the company's power site at High Falls, 30 miles upstream. The company has a dam at High Falls which provides a head of 150 ft. and could be enlarged to provide for a power development of possibly 100,000 ft., storage being obtained by backing up the waters of Whitefish Lake. The energy would be exclusively used to supply power and generate steam for the mill.

HYDRO-ELECTRICITY ON THE JORDAN. —The construction of the long-discussed hydro-electric power plant on the Jordan is now proceeding, and it is expected that the first units, having a capacity of 24,000 hp., will be completed before the end of 1929. Sixty million kilowatt-hours per annum of electrical energy will then be available, and a considerable reduction in the price charged for energy at Jaffa, Haifa and Tiberius is anticipated. Palestine will have advantages, unique in the Near East, in cheap power, proximity to markets, skilled and intelligent workmen, and the commercial aptitude and enterprise of its new population.

C., B. & Q. TO HAVE POWERFUL GAS-ELECTRIC CARS. — Eight of the most powerful single-unit gas-electric railway cars ever built will be used by the Chicago, Burlington & Quincy Railroad as a part of the large fleet of these vehicles being built up by that railroad. A total of 53 gas-electric cars is so far involved in the program, and an additional 36 will be in service by September, of which 28 are being built by the General Electric Company. As fast as they are delivered they are replacing steam trains in light traffic and branch-line service on various parts of the Burlington system. Each of the eight cars most highly rated is equipped with a 400-hp. eight-cylinder Winton engine. The engine drives an electric generator supplying power to two 220-hp. motors on the front trucks. A total of 400 hp. is thus available from the power plant, whereas the maximum available power from a single car heretofore has been from 275 hp. to 300 hp.

POWER GENERATION BY WINDMILL IN CANADA.—In the annual report of the National Research Council of Canada, just issued, attention is directed to studies made concerning the possibility of the commercial utilization of the winds of the prairies in the development of electric power and of its storage for use on individual farms. "The amount of wind on the Canadian prairies is such," the report says, "that it seems a particularly favorable location for the generation of electricity, provided that the cost is not prohibitive. A windmill with a 10-ft. propeller geared to a 1-kw. direct-current generator producing current at 120 volts has been installed, and a record is being kept of the total amount of power generated. During the five winter months in which it has been under test the monthly generation of power has varied from 80 kw. to 200 kw., an amount ample for all light and a reasonable amount of power on an ordinary farm. A number of types of storage batteries will be tried out, in order that it may be determined which is most suitable for this particular purpose."

Recent Court Decisions

HIS FAILURE TO USE ORDINARY CARE PREVENTS RECOVERY FOR DEATH OF MAN FAMILIAR WITH ELECTRICAL DANGER.—When one Bell was in the act of erecting a private aërial pole with the aërial wire trailing to the ground and in contact with his body, the top of the pole struck a highly charged uninsulated electric wire belonging to the Eastern Shore Gas & Electric Company, and his instant death resulted. The evidence in his widow's suit against that company showed that he had knowledge of the presence and dangerous voltage of the wire as it had been maintained in the same condition for over three years with a warning sign posted, "Danger, 23,000 volts," and that he was familiar with electrical danger since he had at times assisted as ground man in repairing electric lines. The trial judge ruled that there could be no recovery as the decedent failed to observe ordinary care for his protection from danger with which he was long familiar. The Maryland Court of Appeals has affirmed the finding.

DEFECTIVE ELECTRIC WIRING AS THE CAUSE OF FIRES.—"It is a matter of common knowledge that whenever mystery surrounds the origin of fire defective electric wires are invariably charged as the cause." Making this positive statement in Boomer vs. Southern California Edison Company, a suit for damages because of injury to household furnishings by a fire alleged to have been due to high-tension transmission wires attached to plaintiff's house, the District Court of Appeal reversed the finding. The higher court held that expert testimony did not support the charge that the fire was caused by the defendant's service wires; that, on the contrary, there had been no short circuit, the transformer had not been burned out, nor had the fuses exploded. In a suit between the same parties for the destruction of the plaintiff's house in the same fire, the court also reversed a finding for the plaintiff, overruling on the evidence an issue of trespass and holding that a second issue of negligence had not been sufficiently presented, but that even if it had been, it would have been properly overruled on the same grounds as in the suit first summarized—that the evidence did not prove the cause of fire to have been the electric wires. 267 Pac. 178 and 181.)*

Commission Rulings

MUNICIPAL PLANT NOT ALLOWED TO INSIST ON INDIVIDUAL METERS.—Must there be a separate meter for every tenant of a large business or residential building? Figuring the saving to individual customers of the plant concerned at only 6 cents a year and the hardship and injustice involved to public utility companies elsewhere and to operators of office and apartment building as material, the Indiana Public Service Commission has refused to approve a rule of this kind made by the town of Ladoga and affecting the Ladoga Masonic Building, on the ground that, if approved, a similar principle would have to be applied to the larger towns and cities of the state.

EXCESSIVE PURCHASE PRICE MUST BE CHARGED TO PROFIT AND LOSS.—In granting the joint application of the Tuolumne County Electric Power & Light Company and the Pacific Gas & Electric Company for the sale of the former to the latter for $160,500, the California Railroad Commission, observing that the purchase price was in excess of any valuation figures submitted, ordered that the difference between the sum paid and the actual or estimated historical cost of the properties, including land at present value, be charged to profit and loss and not to fixed capital. This was in accordance with the commission's precedents.

UNDERGROUND CONSTRUCTION TO AVOID INTERFERENCE WITH TELEPHONE NOT MADE OBLIGATORY. — The Massachusetts Department of Public Utilities refused to order the Edison Electric Illuminating Company of Boston to place its wires in underground conduits on certain wide streets in Winchester, Mass., where it had obtained a location in which high-voltage current could be carried on overhead wires without danger. The Town Board asserted that the construction was unsafe and pointed to the impossibility of maintaining telephone wires on the same poles. The department held that it would be unfair to make the electric company remove its wires and build conduits for the indirect benefit of the telephone company where the existing condition was not otherwise dangerous. In such a situation, the department said, a telephone line ought to construct its own pole line or conduit system.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

H. H. Bailey Assumes New Duties in Chattanooga

H. H. Bailey has recently been appointed superintendent of production for the Tennessee Electric Power Company, with headquarters in Chattanooga, Tenn. For the past several years Mr. Bailey has been superintendent of production of the Nashville Railway & Light Company, a subsidiary of the Tennessee Electric Power Company. In his new position he will still maintain supervision over the power plant of that company, which is operated as a part of the Tennessee Electric Power Company's system.

Mr. Bailey is a graduate of Ohio State University, and has had a number of years' experience in power plant designing, construction and operation. At the time of his transfer from Nashville, he was president of the Engineering Association of Nashville. He is a member of the Tennessee State Board of Architectural and Engineering Examiners, associate member of the American Society of Mechanical Engineers and of the American Institute of Electrical Engineers.

JOHN D. BALL, vice-president of the School of Engineering of Milwaukee and a fellow of the American Institute of Electrical Engineers, has been given the degree of doctor of philosophy by Marquette University.

JOHN D. RYAN, president of the Montana Power Company and chairman of the board of directors of the Anaconda Copper Mining Company, has been elected a director of the American Power & Light Company. This holding company controls the Montana Power organization.

HAROLD B. CONVERSE has recently been appointed director of public and employees' relations for Charles H. Tenney & Company, Boston. A native of Vermont, Mr. Converse was engaged for a number of years in educational work, later became interested in the insurance business and during the war he was connected with the industrial relationship department of the United States Shipping Board.

MERLE R. GRIFFETH, for the past twenty years attached to the commercial service department of the New England headquarters office of the General Electric Company, Boston, Mass., and lately in charge of publicity activities there, has resigned to join the investment banking organization of Spencer Trask & Company, Boston, beginning his new connection in the fall. FREDERICK W. BLISS, sales representative of the Edison Lamp Works of the General Electric Company, at Providence, R. I., has been selected to succeed Mr. Griffeth. ROY C. SMITH, assistant to H. F. Wallace, manager of the Edison Lamp Works sales organization for New England, has been appointed sales representative for Rhode Island, with headquarters at Providence, succeeding Mr. Bliss.

T. W. Frech Elected to Vice-Presidency

Theodore W. Frech, who was elected vice-president of the General Electric Company in charge of the incandescent lamp department, as announced in the July 14 issue of the ELECTRICAL WORLD, first became associated with the General Electric organization in 1901, when he affiliated himself with the National Lamp Works as one of Mr. Terry's

T. W. Frech

assistants. During the next year he obtained production experience in the glass and lamp factories of the company in Marlboro, Mass.; San Francisco, St. Louis and Warren, Ohio. From 1904 to 1913 he held various positions in Cleveland, working on the development of the Tantalum lamp, the pressed filament tungsten lamp and the drawn wire tungsten filament. In 1913 Mr. Frech became associated with the Peerless Motor Car Company, remaining as vice-president and general manager until 1922, when he was appointed general manager of the National Lamp Works. Three years later he was appointed associate manager of the incandescent lamp department, taking the position of manager in May, 1927.

JOHN L. HALEY, vice-president and Capitol division manager of the New York Power & Light Corporation, Albany, has been elected chairman of the commercial section of the Empire State Gas and Electric Association. For some years Mr. Haley was connected with Henry L. Doherty & Company, entering the employ of that organization in 1914 as cadet engineer. Subsequently he was assigned to the Denver Gas & Electric Company, the Danbury & Bethel Gas & Electric Company and later to the Hattiesburg (Miss.) Gas, Electric Light & Street Railway Company. In 1922 Mr. Haley was appointed commercial manager of the Adirondack Power & Light Corporation, and upon the formation of the New York Power & Light Corporation in 1927 he was named vice-president and manager of the Capitol division, including Albany, Rensselaer, Troy, Cohoes and Hudson, with offices at Albany.

Dr. GERHARD DEHNE of Berlin has been appointed a member of the managing board of the Second World Power Conference to be held in Berlin in 1930. Dr. Dehne is the ELECTRICAL WORLD'S Berlin correspondent.

O. R. BAILLY, formerly connected with the testing department of the General Electric Company at the Schenectady and Pittsfield works, is now identified with the South American properties controlled by the Electric Bond & Share Company.

THOMAS AHEARN, president of the Ottawa Light, Heat & Power Company, Ltd., has been elected a director of the Royal Trust Company. Mr. Ahearn is a director of the Northern Electric Company, the Bell Telephone Company and the Canadian Westinghouse Company. He was appointed to the Privy Council of Canada early this year.

D. MCLEAN, formerly Deputy Minister of Public Works for Manitoba, Canada, has been appointed Hydro-Electric Commissioner for that province. Mr. McLean, who was graduated from McGill University in 1909, has had a wide experience in electrical engineering, in the course of his career having been in charge of many important undertakings.

HOWARD PETT, district manager of the Consumers Power Company, Jackson, Mich., was elected president of the Michigan Electric Light Association for the year 1928-1929 at the annual convention held at Mackinac Island July 6. E. L. Edwards, who is identified with the Michigan Electric Power Company at Lapeer, Mich., was elected first vice-president and D. W. Hayes, who is connected with the Detroit Edison Company at Port Huron, was elected second vice-president. Herbert Silvester, at the present time affiliated with the Ann Arbor office of the Detroit Edison Company, was elected secretary-treasurer of the association.

PROF. F. C. FENTON, of the agricultural engineering department of Iowa State College, Ames, Iowa, has been selected to succeed H. B. Walker as head of the department of agricultural engineering at Kansas State Agricultural College, Manhattan. Professor Fenton has likewise been chosen to suc-

ceed Professor Walker as secretary, treasurer and state supervisor of the Kansas Committee on Relation of Electricity to Agriculture. Professor Walker recently resigned to become head of the department of agricultural engineering at the University of California.

CHARLES A. JACKSON, formerly hydro-electric engineer for the Pelton Water Wheel Company, is now associated with the Utilities Service, Inc., Troy, Pa., as chief engineer.

T. V. BITTNER, formerly associated with the contract department of the Commonwealth Edison Company, is now identified with the Western United Gas & Electric Company at Elgin, Ill., in the capacity of power engineer.

L. E. VAN ALLEN, manager of the West Penn Power Company at Greensburg, Pa., has been transferred to the company's sales department, where he will engage in rural extension development work. Mr. Van Allen became affiliated with the company in 1923, when he entered the engineering department in Pittsburgh. Subsequently he was transferred to Greensburg.

H. A. STROUD has been appointed merchandising manager of the Keystone division of the West Penn Power Company with headquarters at Ridgway. Mr. Stroud, who is a native of Philadelphia, entered the commercial department of the Keystone Power Corporation after his graduation from Pennsylvania State College in 1925. During the three years work in the Keystone organization he has had wide experience in power sales, rural development, advertising, public relations and merchandising methods.

WARREN VIESSMAN has been appointed engineer in charge of the Bureau of Mechanical-Electrical Service, Baltimore, Md., by Mayor William F. Broening, to fill the position formerly held by Charles F. Goob, now chief engineer of Baltimore. A graduate of Baltimore Polytechnic Institute and the engineering department of Johns Hopkins University, for some time he has been with the Consolidated Gas, Electric Light & Power Company.

E. ARTHUR BALDWIN, who has been connected with the export business of the General Electric Company since 1898, when he entered the foreign department, was recently elected a vice-president of the International General Electric Company, Inc. Following graduation from the Massachusetts Institute of Technology he entered the test course of the General Electric Company and in 1898 he was assigned to the railway engineering department. Later he was transferred to the engineering section of the foreign department, over which he presided for an extended period. In 1912 Mr. Baldwin was made assistant manager of the foreign department, a position he held until the formation of the International General Electric Company, when he became manager of the department of Europe. In 1920 and again in 1922 Mr. Baldwin visited Europe in behalf of the company's interests. In addition to his close association with business in Europe, he maintained contact with other sections of the world through membership on the boards of directors of General Electric foreign selling companies, and from 1916 to 1919 he was president of the South African General Electric Company. A year ago Mr. Baldwin was transferred to the executive staff of the International General Electric Company for special duties in Europe, and upon the retirement of E. A. Carolan on Aug. 1, 1927, he was appointed general European manager.

EBEN B. HASKELL has joined the commercial and industrial department of Charles H. Tenney & Company, with headquarters at Boston, Mass., following eighteen months' service with the General Electric Company at Schenectady, Pittsfield and Lynn.

EDWARD H. BRANSON, engineer in the Pittsfield works laboratory of the General Electric Company and executive assistant to the head of the laboratory, has resigned to become head of the laboratory organization of the General Railway Signal Company, Rochester, N. Y. Mr. Branson has been connected with the Pittsfield works of the General Electric Company since 1913, when he was transferred there from Schenectady. He was active in the Pittsfield section of the American Institute of Electrical Engineers, having served as its secretary and treasurer.

M. W. ARTHUR, manager of the light and power department of the Northern Ohio Power & Light Company, has been elected president of the newly formed Electrical League of Akron, Ohio, the newest trade and industrial body in the city.

G. HENRY THORPE has been appointed commercial manager of the western division of the Central Maine Power Company, with headquarters at Lewiston. His territory includes Lewiston, Auburn, Norway, Limerick and Bridgeton and covers about one-third of the region servied by the property. Mr. Thorpe was previously assistant to the commercial manager of the company.

PROF. FRANZ A. KARTAK, head of the department of electrical engineering at Marquette University, Milwaukee, Wis., has been appointed dean of the college of engineering at that institution. Professor Kartak, who will not take office until after the opening of the next semester, will succeed Dean Frank C. French, resigned. He has been associated with Marquette University since 1921, when he joined the staff after a short connection with the Milwaukee School of Engineering. A graduate of the University of Wisconsin, he became research assistant in electrical engineering for two years and instructor in the same subject for two years at the state university. From 1913 to 1919 he was director of the standards laboratory of the University of Wisconsin and also was a member of the state staff of engineers in charge of working out engineering problems of the state. Dr. Kartak has contributed many articles to the technical press, giving his attention especially to electrical metering and electrical testing methods.

CHARLES E. TULLAR has been appointed manager of the patent department of the General Electric Company, according to an announcement made by A. G. Davis, vice-president. Mr. Tullar, who has been assistant manager of the department since Dec. 27, 1927, succeeds the late A. D. Lunt. Mr. Tullar's early engineering work was with the St. Paul Gas Light Company, Fairbanks, Morse & Company and the government as electrical engineer and draftsman in the supervising architect's office of the United States Treasury Department. On July 1, 1905, he became an assistant examiner in the United States Patent Office, advancing through the various grades until 1917, when he was appointed principal examiner in charge of one of the electrical divisions of the Patent Office. He joined the patent department of the General Electric Company nine years ago.

FRANCIS R. WELLER has incorporated his engineering organization, taking into the company many employees who have been associated with him for a long period of time. Mr. Weller has specialized in the design, construction and operation of public utilities for 25 years, having built a number of important hydro-electric and steam power plants, water works and gas plants operating in fourteen states. The main office of the company will remain in Washington, D. C.

Obituary

WALTER F. FIELD, president of the Safety Cable Company, division of the General Cable Corporation, died July 6. Mr. Field became president of the Safety Cable organization in the spring of 1927 after having served in the capacity of executive vice-president and a member of the executive committee.

EDWIN B. KATTE, prominently identified with the development of electric transportation in the United States and for the past 22 years chief engineer of electric traction for the New York Central Railroad, died at his home in Irvington-on-the-Hudson July 19, after an illness of more than a year. Mr. Katte was born in St. Louis 58 years ago and was educated at Cornell University. It was in 1898 that he entered the service of the New York Central as a draughtsman and, rising steadily in the ranks, he assumed charge of the design, construction and operation of the electric system of the New York Central in 1906. Mr. Katte was a fellow of the American Institute of Electrical Engineers, a former president of the New York Electrical Society and a former vice-president of the American Society of Mechanical Engineers.

Financial and Statistical News

Loewenstein Stocks Up

With the finding of the body of Capt. Alfred Loewenstein, whose death until recently had been unconfirmed, an episode of mystery which has shaken the leading financial markets of the world is closed. While still far below their recent high levels, the so-called Loewenstein stocks have shown a stronger tendency, since there is nothing apparent, on the surface at least, to warrant the drastic downward movement in the prices of these issues. The stocks concerned are Canadian Hydro-Electric Securities Corporation and the International Holdings & Investments Company. Both of these are Canadian-owned companies, but a substantial amount of the stock is owned here. Canadian Hydro-Electric Securities opened this week at around 31½, in comparison with a recent high somewhere in the 80s. International Holdings was quoted around 14 to 15, having been split ten for one, and the record high for the old stock having been around 355.

Consumers Power Reports Increased Sales

General business activities in the territory served by the Consumers Power Company are reflected in the increasing demands for electricity and gas since the first of the year. During this period sales of electricity showed an increase of 17 per cent over 1927 and sales of gas, principally as fuel, showed an increase of approximately 15 per cent. These gains in sales were accompanied by an increase of more than 12,800 customers, making a total number of customers as of July 1 408,454. Of this total, 270,973 were electric and 137,481 were gas customers.

From Jan. 1 to July 1 more than $6,000,000 was expended by the management for property additions, extensions and improvements to provide for the future growth of the business, and it is expected that at least another $6,000,000 will be required for such purposes during the remainder of the year.

Hearing Closed on New York Utility Merger

The hearing before the Public Service Commission held last Wednesday on the application of the Consolidated Gas Company for permission to acquire control of the Brooklyn Edison Company brought a protest from Morris L. Ernst, counsel for the Public Committee on Power. He claimed his client was not permitted to appear in the proceedings, but Mr. Ernst was given permission to file a brief. The brief alleged that the application is only defensible on the theory that the merger will result in operating savings and to the extent that if there are such savings they should be used to the advantage of the public.

George B. Cortelyou, president of the Consolidated Gas Company; Nicholas F. Brady, president of the New York Edison Company and the United Electric Light & Power Company, a subsidiary of the Consolidated, and a director and member of the executive committee of the Brooklyn Edison Company, and M. S. Sloan, president of the Brooklyn Edison Company, were called as witnesses. These three executives discussed the savings which would grow out of the contemplated merger.

Assistant Corporation Counsel Hyatt, on behalf of the city, indicated little opposition to the merger and Dr. John Bauer, the city's expert, maintained that the position of the city is only to see that the capitalization of the companies is kept down to a proper and reasonable figure. The hearing was closed, but Chairman W. A. Prendergast gave Mr. Hyatt until Monday to analyze the balance sheets of the two companies.

Cleveland Electric Net Revenue Up 10 per Cent

Costs Kept Well in Hand and Operating Ratio Is Substantially Reduced During Year—Current Quotation of Common Stock Thirteen Times Earnings

KEEPING its operating costs down to a figure only 4.7 per cent over the 1926 total, the Cleveland Electric Illuminating Company was able last year to show a 10 per cent gain in net revenue from a 7.1 per cent increase in gross. This latter is approximately the average advance in gross revenue this year for the industry as a whole. The 10 per cent increase in net is considerably better than the average. Gross earnings were $23,609,479, operating income was $11,352,021, and total net income after all charges was $6,192,398.

In disbursements to shareholders, the Cleveland Electric Illuminating Company has been liberal, while at the same time following a conservative policy in returning an adequate proportion of earnings to property. The average price of the common stock five years ago (during 1923) was about $125. At a current price of around $425 the shareholder has realized a handsome appreciation on his investment, in addition to receiving his annual dividend, which is now 10 per cent on the $100 par.

Earnings per share on the common stock last year amounted to $31.43, against $30.25 the year before. Last year's earnings were thus approximately thirteen times the current price of the stock.

Operating costs, as already intimated, have been kept well within bounds. The operating ratio in 1927 was 51.9, against 52.9 the year before. The property investment at the end of 1927 amounted to approximately $3.95 per dollar of gross earnings. This is an unusually satisfactory showing.

According to the annual report just published, the company's maximum load for the calendar year 1927 was 293,731 kw., which is an increase of 2.3 per cent over the maximum for the previous year. This was the greatest demand ever made on the generating facilities of the company. Power generated amounted to 1,174,676,926 kw.-hr., which is a 5.1 per cent increase over the previous year's output. The total number of consumers at the end of the year was 282,441, which represents an increase of 3.6 per cent during the year. It is significant that 158 new industrial and commercial consumers, each having a load in excess of 25 kw., were added during the year. It is also significant that the company spent $7,225,591 on betterments and extensions during 1927 in order to keep plant and equipment in thoroughly efficient and modern condition.

At the beginning of the year the Cleveland Electric Illuminating Com-

Distribution of Earnings

		Per Cent
Residence light and power	$6,695,985	28
Commercial light and power	3,338,076	14
Wholesale light and power	11,044,430	47
Municipal street lighting	816,316	3
Other municipal light and power	362,942	2
Steam heating	1,351,727	6
Total	$23,609,479	100

pany announced a substantial reduction of electric rates to domestic, commercial and industrial users.

CONSUMERS POWER INCREASES PREFERRED STOCK.—Stockholders of the Consumers Power Company will vote Aug. 7 on approving the creation of an authorized issue of 250,000 shares of no-par value preferred stock. At present the company has authorized an issue of 6 per cent cumulative preferred stock of $100 par value to the amount of $75,000,000.

CALIFORNIA UTILITY COMPANY TO ISSUE BONDS. — The San Gorgonio Power Company, operating in Riverside and San Bernardino Counties, has been authorized by the Railroad Commission of California to issue and sell, on or before Sept. 30, 1928, at not less than 97 per cent of face value, plus accrued interest, $17,000 of its general and refunding mortgage bonds and to use the proceeds to pay in part its outstanding indebtedness and to make improvements to its properties.

MISSOURI STOCKHOLDERS TO VOTE ON STOCK ISSUE.—Stockholders of the Missouri Power & Light Company, Mexico, Mo., at a meeting to be held Aug. 20 will determine whether the company shall issue new $6 dividend non-par preferred stock to be used to finance the retirement in part of outstanding 7 per cent preferred stock.

RICHMOND'S UTILITIES REPORT EARNINGS.—The electric, gas and water utilities of the city of Richmond, Va., earned a net income during 1927 of $892,841, according to an announcement made by George H. Whitfield, director of public utilities. Of the total $104,978 was turned over by the department to the municipal sinking fund for the redemption of bonds, while the remainder, $787,963, went into the surplus account of the city.

COMMUNITY POWER & LIGHT DECLARES DIVIDENDS.—The Community Power & Light Company has declared a dividend of $1.50 a share on its first preferred stock, $6 dividend series, payable Aug. 1 to stockholders of record as of the close of business July 21. The company also declared a cash dividend of 75 cents a share on its common capital stock, payable on Aug. 1 to stockholders of record as of July 21.

PENN PUBLIC SERVICE BONDHOLDERS OFFERED EXCHANGE PRIVILEGE.—First mortgage 50-year 5 per cent gold bonds of the Penn Public Service Corporation have been called for redemption at 103 and interest on Aug. 1, 1928. For the benefit of the holders of those who wish to retain an investment in the Associated Gas & Electric System, the privilege is offered of exchanging the bonds on the basis of $1,000 of these bonds for any of the following securities of the Associated Gas & Electric Company: (a) $1,030 of 6 per cent convertible debentures; (b) 4½ per cent convertible gold debentures due 1948, with detachable stock purchase warrants at the market (based on the preceding day) in exchange for Penn bonds at the redemption price of $103 with adjustment for

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 24	Low 1928	High 1928
ABITIBI PWR. & PAPER, com. new—no par	59¼	57	85
Ala. Pwr., $7 cum. pf.—no par	*m* 114½	114½	115½
Allis Chalmers Mfg., 6% com.	*m*124	115½	129¾
Aluminum Co. of Amer., com.	*m*135½	120	197¾
Aluminum Co. of Amer., 6% pf.	107½	105½	110½
Amer. & Foreign Pwr.7% pf.—no par	108	104¾	110
Amer. & Foreign Pwr., com.—no par	33¾	22¼	38¾
Amer. Bosch Magneto, com.—no par	32½	15¾	41
Amer. Brown Boveri Elec.†	14¼	10¾	26¾
Amer. Brown Boveri Elec., pf. $7	56½	40¼	65¾
Amer. Gas & Elec., 6% pf.—no par	*m*106½	105	108¼
Amer. Gas & Elec., com.†—no par	157¾	117¼	184
Amer. Lt. & Trac., 6% pf.	118	116	120
Amer. Lt. & Trac., new com.	220	170	249
Amer. Pwr. & Lt., 6% pf.	102½	102	109
Amer. Pwr. & Lt., com.†—no par	79½	62½	95
Amer. Pub. Serv., 7% pf.	*a*101	97½	104
Amer. Pub. Serv., com.†	*m* 60	...	...
Amer. Public Utilities, 7% pfc. pf.	*a*101	93¾	101
Amer. Public Utilities, 7% pr. pf.	*a* 93½	93¼	101
Amer. Public Utilities, com.	*m* 50	...	...
Amer. States Sec., A	10¼	7¼	14
Amer. States Sec., B	14¾	7¼	18¼
Amer. Superpower, 6% 1st pf.	*l* 97	...	...
Amer. Superpower, Class A —no par	36	33¾	56
Amer. Superpower, Class B†—no par	*m* 35½	35¼	56¾
Amer. Wtr. Wks. & Elec., 6% pf.	*m*103½	100	106
Amer. W. W. & E., com. new—no par	56½	52	70¾
Anaconda Copper cap. $3	67¼	54	74¾
Appalachian Electric Pwr., 7% pf.	109	107	110
Arkansas Pwr. & Lt., 7% pf.	106	108	109½
Assoc. Gas & Elec., $3.50—50	52¼	...	...
Assoc. Gas & Elec., pf.—$6—no par	93¾	96	98½
Assoc. G. & E., Class A, 10—no par	48¼	47	52¾
BABCOCK & WILCOX, 7% com.	120	118	127
Binghamton L., H. & P., $6 pf.	101	102	109½
Birmingham Elec., pf.—$6—no par	107	104	107
Blackstone Valley G. & E., 6% pf.	*m*105	106	112
Blackstone Valley Gas & Elec., 10% com.—50	*m*165	135	170
Blaw-Knox com.†	*i* 103½	91	108
Brazilian Trac., Lt. & Pwr., com., new	*f* 55½	...	...
Broad River Pwr., 7% pf.	103	105	108¾
Brooklyn Edison, 8% com.	240	206¾	268¾
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	*l* 26	...	...
Buffalo, Niagara & East. Pwr. com. $1.20—no par	*l* 39¼	...	...
CALIFORNIA ELEC. GENERATING, 6% pf.	99	98	101
Carolina Pwr. & Lt., pf.—$7—no par	*l*108½	109	111
Central & S. W. Util., $7 pf.—no par	*a*101	99½	105½
Central & S. W. Util., pr. in. $7 pf.—no par	*a*105	102½	112
Central Ark. Ry. & Lt., 7% pf.	102	105	107½
Central Ill. Pub. Serv., $6 pf.	*a* 97½	97½	100½
Central Ind. Pwr., 7% pf.	*a*100	95	101¼
Central Maine Power, 6% pf.	97	96	98½
Central Maine Power, 7% pf.	110	109	112
Central Pwr. & Lt., 7% pf.	103	104½	114
Central States Elec., 7% pf.	113	104	118
Century Electric	*n*130	130	145
Cincinnati Gas & Elec., 5% com.	*g* 99	97¼	100½
Cities Service, $6 pf.—no par	*i* 99½	94¼	103¾
Cities Service, pf. B—no par	*l* 9½	8¾	9¾
Cities Service, pf. BB—no par	*l* 95	88¼	97
Cities Service, com.—20	*l* 63¼	54	71¼
Cities Service, Bks. Shrs.—10	*l* 31½	26¾	35¾
Cities Service Pwr. & Lt., 7% pf.	*m*106	106	109½
Cities Service Pwr. & Lt., 6% pf.	99½	95	101¼
Cleveland Elec. Illg., 6% pf.	109	109	115½
Cleveland Elec. Illg., 10% com.	425	350	425
Columbia Gas & Elec., 6% pf.	107½	106	110½
Columbia G. & E. com. $5—no par	114¾	89½	118¾
Columbus Elec. & Pwr., 7%	110	...	...
Columbus Ry., Pwr. & Lt., 6%	104	107	111
Columbus Ry., Pwr. & Lt., 6½% pf. B	103	105	111
Columbus Ry., P. & Lt., com. no par	125	120	125
Commonwealth Edison, 8% com.	*a*184	165	189
Commonwealth Pwr., 6% pf.	100	100	104¾
Commonw'th Pwr., $2, com.—no par	76½	62½	87¼
Conn. Lt. & Pwr., 8% pf.	117	120	123
Conn. Lt. & Pwr., 7% pf.	115	118	121
Cons. Gas of N. Y., pf.	*m*101	100½	105
Cons. Gas of N. Y., com. $5—no par	144¾	119¾	170½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 6% pf.	*e*110½	109¼	114½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 5% Pf.	*e*102	100	105¾
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, com. $3.00—no par	*e* 79½	67¼	93
Consolidated Power & Lt., 7% pf.	105	106	109
Consumers Power, 6% pf.	103½	105½	106½
Consumers Power, 6.6% pf.	104	106	107
Continental Gas & Elec., 7% pr. pf.	105	106½	108½
Conti. G. & E. com. $4.40—no par	*m*225	240	265
Crocker Wheeler, com.†	80	23	85
Crocker Wheeler, 7% pf.	97	77	100
DALLAS PWR. & LT., 7% pf	110	110	111½
Dayton Pwr. & Lt., 6% pf.	107½	107	110½
Derby Gas & Elec., 7% pf.	98	96	100½
Detroit Edison, 8% com.	198	166½	209½
Dubilier Condenser, com.—no par	3½	2¼	5½
Duke Pwr., cap.	135	130	148½
Duquesne Lt., 5% pf.	*m*100½	100¼	116½
EASTERN NEW YORK UTIL., $7 pf.	*m*110	111	112½
Eastern States Pwr. B	*m* 18	12	24
Eastern States Pwr., pf.	*m*100½	98	100½
East. Tex. Elec., 7% pf.	107	106	109
Edison Elec. of Boston, $12 com.	*d*278	252	305
El Paso Elec. 7% pf.	*m*111½	110	112½
Elec. Bond & Share, 6% pf.	*l*110	108¾	111½
Elec. Bd. & Sh. Sec., com. $1—no par	99½	76	127½
Electric Household Util.†	*a* 23	13½	27
Elec. Investors, 6% pf.—no par	99	101	104½
Elec. Investors, com.†—no par	61¼	40½	79½
Elec. Pwr. & Lt., ctfs. pf.	107½	106½	110½
Elec. Pwr. & Lt., ctfs., com.—no par	34	28¼	45½
Elec. Ry. Securities, com.—no par	6¼	...	...
Elec. St. Battery com. $5.25—no par	77	69	84¼
Elmira Wtr., Lt. & R.R., 7% pf.	105	104	115
Empire Pwr., pfc.†	*m* 34½	30	39½
Engr. Pub. Serv. $5, pf.—no par	*m* 97	97	102
Engr. Pub. Serv., com.—no par	37½	33	46¼
Eureka Vacuum Cleaner, com. $4—no par, ex.div.	61½	60½	79
FAIRBANKS MORSE, 7% pf.	*m*107½	104	114¼
F.-M., com.—$3—no par	42	32½	54
Federal Lt. & Trac., com. $1.40	*m* 51½	42	56¾
Federal Lt. & Trac., $6 pf.—no par.	102½	98	109
Florida Pwr. & Lt., 7% pf.	*m*102	105	108
Ft. Worth Pwr. & Lt., 7% pf. ex.div.	*l*112	113	114½
GALVESTON-HOUSTON ELEC. 6% pf.	77	75	85
Galveston-Houston Elec., com.	33	31	34
General Cable, Cl. A	64¼	56	84¼
Gen. Elec. $3 com.—no par	148½	124	174½
Gen. Elec., special—6%	11½	11¼	11¾
Gen. Gas & Elec. (Del.), com. A $1.50 no par	51¼	35½	51¼
Gen. G. & E. (Del.) pf. A. $8—no par	135	125	144
Gen. G. & E. (Del.) pf. A $7—no par	118	110	120
Gen. G. & E. (Del.) pf. B $7	114	104	117
Gen. Pub. Serv., $7 pf.	123	115	140
Gen. Pub. Serv., com., no par	22½	16¼	29
General Public Utilities, $7 pf.	*m* 96	98	103
Ga. Lt., Pwr. & Rys., com.	*m* 58	55	65
Gt. Western Pwr., 7% pf.	*h*105	...	...
IDAHO PWR., 7% pf.	109	109	111¼
Ill. No. Utilities, 6% pf.	*a*100½	98½	101
Ill. Pwr. & Lt., $6 pf.	106¼	103	107
Indianapolis Pwr. & Lt., 6½% pf.	*m*103½	102	107½
Indianapolis Pwr. & Lt., $7 pf.	99	100	105
Ingersoll Rand com.	*m* 90	90	98
Int. Combus. Engr., com. $2—no par	60¼	45½	72¼
Int. Combustion Engr., 7% pf.	*m*102	103	109
Int. Util., Class A—$3.50—no par	*m* 46½	44½	52
Int. Utilities, Class B—no par	16¾	3¾	19½
Interstate Pwr., pf.—$7—no par	98	99	105
Interstate Pub. Serv., 7% pf.	106	103	108
Iowa Ry. & Lt., 7% pf.	*m*101	102	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	103	105	107
Johns-Manville, com. — no par	113	96¼	134

Stock Exchange: *c*Chicago; *h*St. Louis; *e*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, July 25. *m*Bid price Saturday, July 21. *n*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 24	Low 1928	High 1928
KANSAS CITY POWER & LIGHT pf. $7	*m*108	108¼	114
Kansas Gas & Elec. 7% pf.	*l*109	107	110
Kelvinator Corp.	12	7¼	22½
Kentucky Hydro-Elec., 7% pf.	*m*103	100	105
Kentucky Secs., 6% pf.	90	90	98
Kentucky Secs., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	105	100	105
LACLEDE GAS LT., 10% com.	*m*226	200	260
Long Island Ltg., 7% pf.	109½	110½	112½
Long Island Ltg., 6% pf.	*m*103	107	109
Long Island Ltg., com.†—no par	*m*250	170	250
Los Angeles Gas & Elec., 6% pf.	*h*108½	105½	112½
Louisville Gas & Elec., cl. A. $1.75	34½	28	41
MAN. ELEC. SUPPLY, cap. $5—no par	62½	50	66½
Maytag Co., com. 50—no par	18½	18½	22
Memphis P. & L., pf.—$7—no par	110	109	111
Metropolitan Ed., pf.—$6—no par	104	103	109½
Metropolitan Ed., pf.—$7—no par	108½	109	111½
Metropolitan Ed., com. $5—no par	*m*160	125	185
Middle West Utilities, cum. pf.	*a* 97	93½	100½
Middle West Util., pr.lien	*a*126	122½	130½
Middle West Util., com. $7—no par	*a*143	123½	169
Midland Utilities, pr. ln. 6% pf.	*a* 94	93	97
Midland Utilities, 6% pf. A	*a* 89	89	92½
Milwaukee Elec. Ry. & Lt., 7% pf.	105	100	106
Milwaukee Elec. Ry. & Lt., 6% pf.	100	98	110
Minn. Pwr. & Lt., 7% pf.	*l*107	107	109
Miss. River Pwr., 6% pf.	108	94	*l*112½
Mohawk Hudson Pwr., 1st pf.—$7—no par	*m*1·8	100	110
Mohawk Hudson Pwr., 2d pf.—$7—no par	104½	100	109
Mohawk Hudson Pwr. com.—no par	*m* 38½	29½	53
Montana Pwr., 5% com.	*m*147	102½	175
Montreal Pwr., com. $2—no par	*l*107	....	....
Mountain States Pwr., 7% pf.	*m*101	97	105
Mountain States Pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	110½
National Carbon, 8% pf.	*a*136	136	139½
National Elec. Pwr., A†	*a* 33½	27½	42
National Pwr. & Lt., pf. 7%	108	106½	111
National Pwr. & Lt., com.†—no par	*n* 32½	21½	36½
National Pub. Serv., 7% pf.	98½	99	104
National Pub. Serv., A com. $1.60—no par	*m* 24½	22	29½
National Pub. Serv., B com.—no par	*m* 30½	24½	32½
Nebraska Pwr., 7% pf.	*l*109	110	111½
Nevada-Calif. Elec., com.	*n* 53	33½	53
New Brunswick Pwr., 4% pf.	*m* 60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	110	98½	110½
New Eng. Pub. Serv., pf. $7	98	95	108
New Orleans Pub. Serv.—7% pf.	106	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	102	91	104
N. Y. Central Elec., 7% pf.	105	101	107
New York Power & Light 7% pf.	112	....	....
No. Amer., 6% pf.—50	*m* 54	53½	55½
No. Amer., com.—10	70½	58½	78½
No. Amer. Edison, $6 pf.—no par	101½	100½	105½
Northeastern Pwr., com.	25½	19½	31
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	*m* 27½	18	32
Northern Ohio Pwr. & Lt., 6% pf.	100	90	100
No. Ont. Lt. & Pr. 6% pf.	*m* 98	94	100
No. States Pwr. (Del.), 7% pf.	109	108½	110½
No. States Pwr. (Del.), 8% com.	135	123	152
No. Texas Elec., 6% pf.	50	45	70
No. Texas Elec., com.	14	....	....
OHIO BRASS, com. B $4—no par.	*k* 90	90	100½
Ohio Brass, 6% pf.	*m*104	106	111
Ohio Pwr., 6% pf.	108	104	109½
Ohio Pub. Serv. $6 pf.	104	95	105
Ohio Pub. Serv., 7% pf.	111½	107	112
Ohio River Edison, 7% pf.	107	106	109½
Oklahoma Gas & Elec., 7% pf.	110½	106	115½
PACIFIC GAS & ELEC., 6% pf.	27½	25½	29
Pacific Gas & Elec., 8% new com.	48	43½	53½
Pacific Pwr. & Lt., 7% pf.	*l*109	106	110
Packard Electric, com.	*k* 64	47	68½
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 79	78½	82
Penn-Ohio Edison, 6% pf. no par	*m* 95	78	99
Penn-Ohio Edison, 7% pf.	108	97½	109
Penn-Ohio Pwr. & Lt., 7% pf.	107	....	....
Penn Pwr. & Lt.—$7—no par	*l*109	109½	110½
Penn Wtr. & Pwr., $2.50 com., new	*e* 76	68	80
Phila. Co., 5% pf.—50	*m* 47	45½	48½
Phila. Co., 6% pf.—50	55½	52	57
Phila. Co., com.—50	*m*150	145	174½
Phila. Elec., 8% com.—25	*c* 65½	55½	74½
Portland Elec. Pwr., 7% pf.	102	100	106
Portland Elec. Pwr., 6% pf.	93	78	96
Portland Elec. Pwr., 6% 2d pf.	102	55	88
Portland Elec. Pwr., com.	43	....	....
Potomac Elec. Power, 6% pf.	*l*111½	....	....
Pwr. Sec., pf.—no par	60	50	68
Pwr. Sec., com.—no par	*n* 13½	11½	14½
Public Serv. of Colorado, 7% pf.	107	....	....
Pub. Serv. of N. J., 6% pf.	*m*107	103½	115
Pub. Serv. of N. J., 7% pf.	126½	118	129½
Pub. Serv. of N. J., $2 com.—no par	54½	41½	66½
Pub. Serv. of No. Ill., 6% pf.	*a*120½	110	120½
P. S. of No. Ill., com. $8—no par	*n*187	159½	190½
Pub. Serv. of No. Ill., $8 com.	*a*184	139½	190
Pub. Serv. of Okla., 7% pr. ln.	109	100	107
Pub. Serv. Elec. & Gas, 6% pf.	108½	107½	110½
Puget Sound Pwr. & Lt., 7% pf.	*m*110	105	110
Puget Sound Pwr. & Lt., $6 pf.—no par	98½	96½	105½
Puget Sound Pwr. & Lt., com.	80	34½	94½
RADIO CORP. OF AMER., $3.50 pf.—50	*m* 56	54½	60
Radio Corp. of Amer., com.—no par	169	85½	224
Rochester Gas & Elec. 6% pf. D	105½	105½	106½
Rochester Gas & Elec., 7% pf. B	107	105	108
Rochester Gas & Elec., 6% pf. C	105	105½	106½
SAN JOAQUIN Lt. & Pwr., 7% pf.	117	110	117½
St. Joseph Ry., L., H. & P., 5% pf.	*m* 75	70	75
Servel, Inc.	13	4½	17½
Shawinigan Water & Power.com., $2 no par	*f* 90½	....	....
Sierra Pacific Elec., 2% com.	*m* 44	29	49½
Sioux City Gas & Elec., 7% pf.	104½	100	108½
Southeastern Pwr. & Lt., pf.—$7 no par	*l*106	....	....
Southeastern Pwr. & Lt., pfc. pf.	*l* 87	....	....
Southeastern Pwr. & Lt., com.—no par	46½	40½	61
So. Calif. Edison, 8% pf.	49	38½	53
So. Calif. Edison, 7% pf.	29	27½	29½
So. Calif. Edison, 6% pf.	27	25½	28
So. Calif. Edison, 8% com.	47	43½	53½
Southern Cities Utilities, 7% pf.	83	75	92
Southwestern Lt. & Pwr., A $3	65	60	80
Southwestern Lt. & Pwr., B	50	....	....
Southwestern Lt. & Pwr., $6 pf.	90	88	96½
Southwestern Pwr. & Lt., 7% pf.	112	103	115
Standard Gas & Elec., 8% pf.	66½	65	71½
Standard Gas & Elec., 7% pr. pf.	110	108	115
Standard G. & E., com. $3.50	64½	57½	74½
Standard Power & Light, com.	*m* 46½	29½	58½
Standard Pwr. & Lt., 7% pf.	*m*105	98	106
Staten Island Edison, pf.—$6—no par	98½	99	103½
Superheater, $6 com.—no par	148	145	178
Syracuse Lighting, 7% pf.	110	103	112½
Syracuse Lighting, 8% pf.	*m*120	114	121
TAMPA ELEC., com. $2	63½	62	71
Tenn. Elec. Pwr., 6% pf.	99	92	103
Tenn. Elec. Pwr., 7% pf.	106	107	110
Tex. Pwr. & Lt., 7% pf. ex. div.	*l*112	113½	115
Tide Water Pwr., 8% pf.	106	108	112
Timken Roller Bear., com.—$4 no par	121½	112½	134
Toledo Edison, 7% pf.	109	108	111
Toledo Edison, 6% pf.	105	95	105
Toledo Edison, 6% com.	*m*145	120	150
Tri-City Ry. & Lt., 6% pf.	90	88	102
UNITED GAS & ELEC., 7% pf.	95	98	103
United Gas & Elec. (N. J.), 5% pf.	75	70	77
United Gas Impr., 8% com.—50	*c*132½	114½	149½
United Lt. & Pwr., pf.—$4—no par.	57½	52½	58
United Lt. & Pwr., pf.—$6.50—no par	98½	94½	103½
United L. & P., com. A .48—no par	*a* 25½	14	27½
United L. & P., com. B .48—no par.	*m* 37	20	37
Utah Pwr. & Lt., 7% pf.	*l*108	109½	112
Utica Gas & Elec., 7% pf.	106	105	107
Utica Gas & Elec., 8% com.	*m*200	215	225
Utilities Pwr. & Lt., 7% pf.	99	98	104
Utilities Pwr. & Lt., com. A $2	38½	28½	45½
Utilities Pwr. & Lt., com. B $1—no par	*m* 27½	18½	32½
VERMONT HYDRO-ELEC., 7% pf.	99	95	102
Virginia Elec. & Pwr., 7% pf.	*m*108	108	111
Virginia Public Service 7% pf.	104	97	103½
WAGNER ELEC., 7% pf.	*b*104	96½	107
Wagner Elec., com.—no par	*b* 83	37	120
Washington Ry. & Elec., 7% com	*j* 450	....	....
Washington Ry. & Elec., 5% pf.	*j* 99½	....	....
Washington Wtr. Pwr., 8% com.	225	175	235
West Penn Elec., 6% pf.	110	108	115
West Penn Elec., 6% pf.	99½	98½	104½
West Penn Pwr., 7% pf.	115½	114½	118
West Penn Pwr., 6% pf.	*m*103½	103	113
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	104	98	105
Western States Gas & Elec., 7% pf.	*m* 99	100	106
Westinghouse Elec. & Mfg., 8% com.—50	94½	88½	112
Weston Elec. Instrument, Cl. A $2—no par	33	30½	36½
Weston Elec. Instrument, com.—no par	22½	12½	28½
Wheeling Elec., 6% pf.	106	95	109
Worthington Pump, 7% pf. A	*m* 50	46½	58½
Worthington Pump, 6% B	48	41	51
Worthington Pump, com.	37½	28	39½
YALE & TOWNE com. $5—25,	*m* 68	68	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, July 25. *m*Bid price Saturday, July 21. *n*Latest quotations available. †Dividend rate variable.

accrued interest; (c) ten shares of $6 dividend series preferred stock, or (d) $1,065 of consolidated 4½ per cent gold debenture bonds, due 1958.

RECENT LISTINGS.—The New York Stock Exchange has authorized listing of certificates of deposit of the Brooklyn Edison Company issued and to be issued by the National City Bank, New York, as depositary, for 900,000 shares (par $100) capital stock, which are listed and outstanding, on official notice of issuance in exchange for outstanding stock certificates representing shares of the capital stock. There have also been authorized for listing by the New York Stock Exchange temporary certificates for 131,370 additional shares (authorized 1,500,000 shares) $4 cumulative preferred stock, without par value, of the Standard Gas & Electric Company upon official notice of issuance and payment in full, making the total amount applied for not to exceed 666,629 shares of $4 cumulative preferred stock. The additional stock was offered for subscription at $66 per share to holders of the $4 cumulative preferred stock of record June 12, 1928. Rights expired July 12. Foreign securities were recently authorized for listing—5 per cent external sinking fund gold bonds of the Oslo Gas & Electricity Works (Norwegian) totaling $6,000,000.

PUBLIC SERVICE ELECTRIC & GAS RECEIVES AUTHORIZATION.—The Board of Public Utilities Commissioners of New Jersey has authorized the Public Service Electric & Gas Company to issue 1,500,000 shares of no-par value common stock at $10 a share. The proceeds will be devoted to improvements and extensions.

AMERICAN UTILITIES COMPANY OFFERS RIGHTS.—The American Utilities Company, which was formed during the latter part of 1925, is about to acquire certain electric light and power, gas and ice properties in New York, Pennsylvania, Delaware, Tennessee and Arizona. In order to provide the funds required for the acquisition of these properties, and for certain other purposes, the company has sold to bankers an additional amount of its first lien and refunding 6 per cent bonds and fifteen-year, 6½ per cent gold debentures. As part of its present financing, the company is offering to its stockholders $21,150 additional shares of its

common stock at $15 per share, on the basis of one-third share for each share already held.

Massachusetts Adds to Legal Investment List

The Bank Commissioner of the State of Massachusetts issued on July 1 a list showing the bonds and notes which, in the opinion of the Banking Department, are now legal investments for savings banks in Massachusetts. Among the light and power securities which have been added to the list since Feb. 1, 1927, the date the last list was issued, are the following:

Binghamton Light, Heat & Power first and refunding mortgage 5s, 1946; Central Maine Power first and general mortgage series E 4½s, 1957; Potomac Electric Power first mortgage 5s, 1929; consolidated mortgage 5s, 1936; general and refunding series B, 6s, 1953; Manchester Traction, Light & Power first and refunding mortgage 4½s, 1957; Queens Borough Gas & Electric general mortgage 5s, 1955; refunding mortgage 4½s, 1958; Rockland Light & Power first and refunding mortgage 4½s, 1958.

The following is a list of light and power securities which have been dropped from the legal investment class since the publication of the list dated Dec. 1, 1927:

New Bedford Gas & Electric Light first 6s, 1928; first 7s, 1928; Eastern New Jersey Power first mortgage 5½s, 1949; first mortgage 6s, 1949; Indianapolis Light & Heat consolidated mortgage 5s, 1940; Pacific Gas & Electric first and refunding mortgage series A 7s, 1940; Queens Borough Gas & Electric refunding mortgage 6s, 1953; refunding mortgage 5s, 1953; Southern California Edison gold debentures (serial) 7s, 1928; Western New York Utilities first mortgage gold 5s, 1946; Wisconsin Power & Light first lien and refunding mortgage series C 6s, 1944; first lien and refunding mortgage, series D 5½s, 1955.

In practically every case these securities matured, were called for payment or the company has been consolidated with some other organization and is no longer operating.

Southern California Edison Half Year Earnings

Gross earnings of the Southern California Edison Company for the six months ended June 30, 1928, amounted to $16,896,327, as compared with $14,867,922 for the corresponding period of 1927, an increase of $2,028,405, or 14 per cent. Net earnings after deducting operating expenses and taxes were $11,379,084, as against $10,024,636, an increase of $1,354,448, or 14 per cent. After fixed charges the balance remaining for dividends and depreciation amounted to $8,634,261 for the first six months of 1928, as compared with $6,960,929 for the corresponding period of 1927, an increase of $1,673,331.

Depreciation is estimated at $2,150,000 for the first six months of 1928 and at $1,865,580 for the corresponding period of 1927, leaving a balance available for stock of $6,484,261 in 1928, as compared with $5,095,349 last year. After providing for dividends on preferred stocks, the amount available in 1928 for common stock and original preferred stock, which shares equal with the common in all dividends in excess of 7 per cent, was $1.61 per share based on the average number of shares outstanding during the six months. This compares with $1.48 per share earned in the corresponding period of 1927.

Industrial Financing Fund Is Created

Creation of an industrial financing fund for the purpose of aiding the industrial development of South Bend, Ind., by the Northern Indiana Public Service Company and the Chicago, South Shore & South Bend Railroad, both subsidiaries of the Midland Utilities Company, has been announced.

An industrial fund has been established from which money will be loaned to customers and prospective customers of the companies, as a means of aiding in the industrial expansion of the community.

This plan of industrial promotion of the communities served by the companies is in line with the policy of chambers of commerce in many cities throughout the United States.

In some cities community industrial financing organizations have been formed for the primary purpose of assisting in financing industries somewhat along the same general lines. In cities where such community plans now are in effect the companies will participate in the plan. In cities where such a plan is not in operation the two companies will handle the matter through the Chamber of Commerce or some similar organization, or if necessary directly with the manufacturers themselves, depending on the circumstances.

The administration of this fund is under the control of committees, but negotiations will be handled by G. M. Johnson, district manager of the Northern Indiana Public Service Company. It is proposed to loan money on behalf of the companies to customers and prospective customers to be utilized in establishing or developing the business of such customers.

MAYTAG COMPANY TO PAY PREFERRED DIVIDENDS.—Directors of the Maytag Company have declared initial quarterly distributions of $1.50 per share on the first preferred stock and 75 cents per share on the cumulative preference stock (both no-par value), payable Aug. 1 to holders of record July 20.

MEXICAN UTILITIES ELECT NEW DIRECTORS.—Shareholders at the annual meetings of the Mexican Light & Power Company, Ltd., and the Mexico Tramways Company elected Sir Thomas White to the Mexican Light & Power board and C. D. Magee to the board of the Mexico Tramways Company to succeed the late Alfred Loewenstein.

Regional Systems and Transmission in Austria

Of the 1,326,200 hp. in Austrian public utility water power plants, 720,800 hp., or 54.5 per cent, is in those of a regional character, according to a recent consular report, which gives details by provinces.

At the end of 1927 there were 10,239 km. of transmission lines in Austria, of which 4,983 km. were for 10,000 volts and below, 5,027 were for three-phase current above 10,000 volts and 229 km.

TRANSMISSION LINES IN AUSTRIA, DEC. 31, 1927, (KILOMETERS)

	Three Phase 10,000 Volts and Less	Three Phase Above 10,000 Volts	Single Phase* 55,000 Volts	Total
Burgenland	83	197	...	280
Carinthia	644	331	...	975
Lower Austria and Vienna	1,166	1,948	...	3,114
Upper Austria	1,439	1,056	...	2,495
Salzburg	77	461	...	538
Styria	1,024	678	...	1,702
Vorarlberg	102	150	69	321
Tyrol	448	205	160	813
Total Austria	4,985	5,027	229	10,239
Total Dec. 31, 1918	1,850	862	...	2,712
Increase 1918-1927, per cent	169	483	...	278

* Railway electrification.

were single-phase, 55,000-volt transmission lines for railway electrification in Tyrol and Vorarlberg. Most of these lines, including all 55,000-volt railway electrification lines, have been constructed since the war; the length of transmission lines below 10,000 volts increased by 169 per cent and the length of the lines above 10,000 volts by 483 per cent since 1918.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended May 31 1928	1927
Bangor Hydro-Electric	$1,903,507	$1,798,422
Baton Rouge Electric	1,045,976	1,005,464
Binghamton Lt., Ht. & Pwr.	2,306,186	2,027,290
Blackstone Valley Gas & Electric & Subs	6,000,325	5,697,236
Cape Breton Electric	660,037	643,859
Carolina Power & Light	8,943,670	8,594,134
Central Illinois Light	4,538,557	4,317,714
Cities Service	33,074,373	28,929,675
Columbus Electric & Power & subs	4,369,759	3,958,163
Commonwealth Power	55,158,163	51,103,341
Consumers Power	28,094,454	25,277,250
Eastern Texas Electric	7,422,557	6,368,653
Edison Electric Illuminating of Brockton	1,964,607	1,838,728
Electric Light & Power of Abington & Rockland	633,239	586,540
El Paso Electric & subs	3,073,084	2,903,045
Federal Light & Traction	7,331,098	6,815,667
Florida Public Service	1,982,441	1,785,213
Galveston-Houston Electric & subs	5,190,466	4,823,967
General Gas & Elec. & subs	23,281,248	25,220,899
Idaho Power	3,361,941	2,899,371
Illinois Power	2,660,464	2,606,783
Kansas City Power & Light	13,213,593	11,323,054
Metropolitan Edison	10,550,047	9,893,333
Nevada-California Electric	5,367,323	4,949,414
New Jersey Power & Light	2,773,774	2,581,046
North Texas Electric & subs.	2,828,764	2,567,134
Ohio Edison	1,983,906	1,870,578
Penn-Ohio Edison and Northern Ohio Power	25,839,242	25,476,571
Portland Electric Power	12,292,228	12,042,140
Puget Sound Power & Light & subs	14,931,451	14,149,243
Savannah Electric & Power	2,237,206	2,248,168
Sierra Pacific Elec. & subs	1,293,658	1,259,490
Southern California Edison	32,367,472	29,387,007
Southern Indiana Gas & Elec.	3,071,178	2,974,671
Tampa Electric & subs	4,710,102	4,843,566
Tennessee Electric Power	12,834,133	12,151,968
United Light & Power	45,209,643	41,131,067
Utah Power & Light	10,724,553	10,636,194
Virginia Elec. & Pwr. & subs.	15,748,126	14,952,402

Business News and Market Conditions

Operations Continue Above Last Year

Production in Electrical Manufacturing Plants Holding Above Last Year—Six Months' Production 4.6 per Cent Over Same Period in 1927

DURING June the electrical manufacturing plants of the nation reported that productive operations were about 1 per cent under May, but were about 3 per cent over June last year. The operations of the electrical manufacturing plants have been materially above those of last year ever since January, the average rate of operations during the past six months being about 4.6 per cent over the same period in 1927. There appears to be every indication that the second half of the year will continue to show operations in these plants above those of last year. The smaller manufacturing plants seem to be maintaining a slightly higher rate of operations than the larger plants.

The index of activity in the electrical manufacturing industry based on the consumption of electrical energy stands at 118.9 for June, as compared with 120.1 (revised) for May and 115.4 for June, 1927. Comparative indexes of productive activity referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days are as follows:

June, 1928	118.9
May, 1928 (revised)	120.1
April, 1928	128.4
March, 1928	115.3
February, 1928	121.8
January, 1928	124.7
Average first half 1928	121.5
Average first half 1927	116.2
Average first half 1926	110.9
Average full year 1927	119.5
Average full year 1926	116.6

The present productive activities in the electrical manufacturing industry are following in a general way the productive operations of the nation's industry as a whole. General national industry in June witnessed the highest rate of activity ever recorded, after corrections are made for the number of working days and for seasonal variations. Many of the primary industries which at this season of the year are usually reporting materially decreased operations are turning in production reports on a par with those of January and February, and only two or three are reporting a rate of operations under that reported for the same month last year. It seems probable that the present summer months will witness general productive operations on a plane higher than during any previous summer period. The consensus of opinion appears to be that American industry will continue to operate on a high plane during the fall months and that the approaching election will not materially affect the industrial life of the nation.

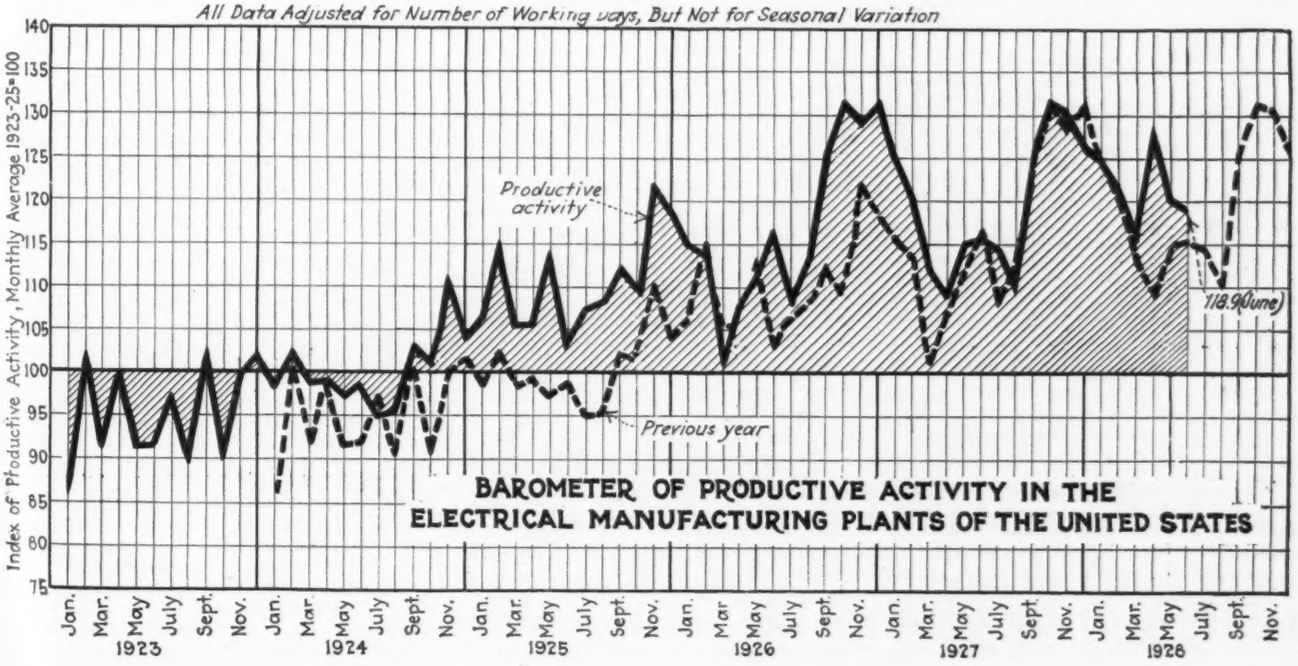
Specialists Expect Wider Use of Nickel

Nickel is certain to come into much wider use as a result of plans looking to large-scale operations on Canadian copper-nickel ores, according to nonferrous metal specialists in Washington. While these ores will be mined primarily for the copper content, the production of a large volume of by-product nickel is expected to have an important bearing on certain other non-ferrous metals which will be displaced if the price of nickel is reduced to the point expected.

Because of its resistance to corrosion, it is thought that cheap nickel will find its principal new use in tubing. The rapid increase in electric cooking, where close contact with the burner is particularly desirable, already has created a new demand for nickel utensils, despite the present high price. If the cost is reduced these specialists believe that nickel ware will be widely used.

Meeting of Welding Society to Include Exposition

The fall meeting of the American Welding Society, to be held in Philadelphia from Oct. 8 to 12, will include an exposition held in co-operation with the American Society for Steel Treating. The exhibit will occupy all the floor space of the exposition hall of the Commercial Museum. Five days will be devoted to displaying to the industrial world the best in welding equipment and supplies and exhibits of welded products also will be shown. It is expected that there will be more than 350 exhibitors covering a space of more than 90,000 sq.ft. A good proportion of this space will be devoted to the welding exhibits. Technical meetings and registration will be held at the Bellevue-Stratford Hotel in the morning and at the exhibition hall in the afternoon of each day.



Market Conditions

BUYING by central-station companies is active in the New England district and inquiries for new station construction material are increasing. Orders for transformers have increased, line extensions are numerous and a steady movement in supplies shows little abatement for the present. In the Eastern district encouraging sales continue. A New York utility company is in the market for substation equipment in sizable amount and early commitments are expected. An improved market for street-lighting equipment is noted.

Though individual orders are small the volume of business in the Southeast is satisfactory. Orders for control and renewal batteries are good, with the best business from Tennessee and Alabama. In St. Louis, sales continue at a good level, with the motor and transformer demand good. Improvement continues in the Middle West, although industrial activity is somewhat spotty. On the Pacific Coast, two large orders were placed, one for motors and pumps for the West Stanislaus irrigation district amounting to $125,000 and the other for $250,000 worth of equipment for the Weyerhauser lumber mill.

Prices Unchanged in Metal Market—Sales Light

Sales of copper are the smallest reported in several months, though most of the producers appear to welcome the respite and not the slightest sign of price weakness is observed. Volume of lead buying was proportionally the largest of any of the metals, the aggregate being but slightly below average. Demand for zinc continues on the easy side, with prompt metal unchanged at 6.20 cents per pound, St. Louis.

NEW YORK METAL MARKET PRICES

	July 18, 1928 Cents per Pound	July 25, 1928 Cents per Pound
Copper electrolytic	14.525	14.525
Lead, Am. S. & R. price	6.20	6.20
Antimony	9.50	9.50
Nickel, ingot	35	35
Zinc spots	6.55	6.55
Tin, Straits	47.69	48.25
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price July 25, 1928, 16½ cents.

Dullness, a feature of the copper market since late June, was noticeable in even greater degree during this week. That July would be a quiet month was not unexpected. Interpretation of June statistics as unfavorable to the producer and the effect of the continued hot weather are probable reasons for the lessening in demand. Sales on foreign accounts amount to about 30,000 tons so far this month, which reflects the domestic situation in being below average.

Though the volume of lead sales has been in the aggregate slightly under the average the inquiry has been steady and the tone of the market is good. Spot lead in London is a little stronger. The position of most producers is comfortable and there is no tendency to shade the prevailing prices. Statistics for world production in June show that the rate (4,375 tons per day), is a little higher than that of either April or May, but substantially under the average for this year or 1927. North America and Burma account for the greater part of the increase in June. It is reported that the Interstate Commerce Commission has now given its approval to the reduction in rate from $7 to $5 per ton applying to lead shipped from St. Louis to New York. It is understood that the Eastern Traffic Executive Committee proposed the reduction at the instance of prominent consumers of lead, and that the I.C.C. has recently held hearings on the proposal.

Central Station Buying Active in New England

Advance in the volume of buying of central-station supplies is recorded in the New England district. One prominent representative notes that the number of inquiries for new station construction material is increasing. Orders for transformers are being received in greater number than last month and line extensions are numerous and reflect a steady movement in pole-line supplies, which shows little abatement for the present. Small switches, outside control apparatus and insulators are in good demand. Orders for these are small but in fair volume. Two water-wheel units for a new Vermont hydro-electric plant and two Westinghouse 2,000-kva. generators for direct connection to those units were recently purchased.

Business in heavy industrial equipment is quiet. Small motor sales continue at a good rate. Sales reported by a prominent manufacturer reached over $30,000, and another records several lot sales, among which is noted a group costing about $4,500. In addition, sales of motors over 15 hp. show an encouraging trend. Street lighting is attracting attention and automatic traffic control signals are in favor throughout the district. Commercial types of baking ovens are in active demand. A full electric baking equipment for the Bradford Academy in Haverhill, Mass., was recently ordered.

Business Continues Active in St. Louis District

Sales in the St. Louis district continue at a good level with motor and transformer demand good. Manufacturers report exceptionally good sales of 2-hp. to 5-hp. motors, mainly to industrial concerns which are increasing their output. A contract covering a switchboard for Oklahoma was closed at a cost of $20,000 and another for a switchboard for west Missouri amounted to $10,000. An order also was reported for a 50,000-kva. bank of transformers. Construction projects are as follows:

The Louisiana Power & Light Company, New Orleans, plans a transmission line from St. Joseph to Tallulah, La. The General Tire & Rubber Company, Akron, Ohio, plans a distributing plant at Kansas City, Mo., to cost $200,000. The State Board of Public Affairs, Oklahoma City, Okla., will build a power plant at the State School for the Blind, Muskogee, Okla., to cost $30,000. Cosden & Company, Fort Worth, Tex., plans an oil refining plant near Big Springs, Tex., to cost $500,000. The Fort Worth & Denver City Railway Company, Fort Worth, Tex., plans a repair shop at Childress, Tex., to cost $150,000. The West Texas Utilities Company, Abilene, Tex., plans extensions in transmission line near Quanah, Tex. El Reno, Okla., plans an ornamental lighting system.

Orders Small But Business Good in Southeast

Small individual orders but a satisfactory volume of business is reported in the Southeast. The largest central-station order was for stranded bare copper wire amounting to $10,300, while other orders were for pole line materials amounting to $7,600, distribution transformers totaling $6,000, creosoted pine poles amounting to $5,900 and $3,200 worth of house type meters. One of the smaller central-station companies ordered one carload of poles and $3,500 worth of pole line hardware. Orders are being received for control and renewal batteries, with the best business in Tennessee and Alabama.

A steel mill in Georgia ordered an 800-hp. motor for its rolling mill and a bed spring factory in the same state is ordering $2,000 worth of motor equipment and $1,500 worth of wiring materials for an addition to its plant. A Georgia textile plant placed a small order for parkway cable for use in its mill village lighting system. A fairly good volume of "white-way" equipment business is reported but the orders are generally small, the largest being for 125 standards for a southern Florida city. The government let contracts covering the installation of 25 beacon lights between Atlanta, Georgia, and Selma, Alabama, on the air mail route. Orders from municipalities for pole line materials are in good volume and range from $200 to $700 each. A municipal order for creosoted pine poles amounted to $1,400. Construction projects are as follows:

A. B. Jeffries, Citronelle, Ala., and associates, plan a power plant and a transmission line at Mount Vernon, Ala. The South Georgia Power Company, Albany, Ga., plans an 11,000-volt transmission line from Cordele to Abbeville, Ga. The Mutual Light & Power Company, Brunswick, Ga., plans extensions in transmission line at Darien, Ga. The Georgia Power Company, Atlanta, Ga., will make extensions in substation and transmission line at Winder, Ga. The Chesapeake & Ohio Railway Company, Richmond, Va., plans

an engine house and shops at Ashland, Ky., to cost $500,000, and extensions in repair shops and car works at Huntington, W. Va., to cost $2,000,000. The United States Engineer Office, Louisville, Ky., will receive bids until Aug. 9, for power plant equipment, at dam No. 51, on the Ohio River.

The Ripley Utilities Company, Ripley, Miss., plans a power plant, to cost $50,000. The Charlotte-Coca Cola Bottling Company, Charlotte, N. C., plans a plant to cost $150,000. The Roanoke River Power Company, Richmond, Va., plans a hydroelectric plant on the Roanoke River, near Welden, N. C., to cost $5,000,000, with transmission line. The Farmville Furniture & Cabinet Company, Farmville, Va., will build a plant to cost $100,000. Oxford, Miss., plans a lighting plant to cost $52,000. Huntsville, Ala., plans an ornamental lighting system.

Encouraging Sales Continue in Eastern District

The demand for electrical equipment from central-station companies and industrial interests continues at an encouraging rate in the Eastern district. A New York utility company is in the market for substation equipment in sizable amount and early commitments are expected. A northern New York central-station company will soon make inquiries for a quantity of generating equipment for a new station installation. A manufacturer of control equipment for substation service reports an active demand. A Wisconsin manufacturer is also scheduling increased bookings for pumping and turbine machinery and states that commitments for the first five months of the present year are 15 per cent in advance of those for the same period a year ago. A copper mining company has placed an order for a 7,000-kw. turbo-generator unit for its Western properties. A manufacturer of motors in the Eastern district reports an improved call from automobile plants and cement mills, while the demand from iron and steel interests and textile mills shows a tendency to slacken. An order has been received from a cement mill in Illinois for a number of large direct-current motors, primarily for pump drives, totaling about $12,000. A government contract also has been placed for 140 wind-driven generator units aggregating in excess of $25,000.

A New York central-station company has contracted for a 3,000-kw. steam turbine and switching equipment totaling over $60,000. A brass manufacturer in Connecticut has given an order for a quantity of switching equipment to cost about $15,000. The Chesapeake & Ohio Railway Company is arranging a fund of more than $6,000,000 for extensions in car and locomotive repair shops in Ohio, West Virginia and Kentucky and will make heavy purchases of equipment. There is a better market for street-lighting equipment from Eastern and Middle Western municipalities. Construction operations in the Eastern district include the following:

The American Can Company, New York, plans a plant and a warehouse unit at Denver, to cost $800,000. The Kittenger Furniture Company, Buffalo, N. Y., plans a factory at Los Angeles, to cost $1,000,000. The Great Atlantic & Pacific Tea Company, New York, will build a plant at Toledo, Ohio, to cost $200,000. The Humphreys Shipyard Corporation, Keyport, N. J., will make extensions to cost $75,000. East Orange, N. J., plans extensions in its street-lighting and traffic signal system.

The David Lupton's Sons Company, Philadelphia, Pa., will build a steel sash plant at Chicago, to cost $450,000. The Washington Hosiery Mills, Pottstown, Pa., plans a mill to cost $70,000. The West Philadelphia Stock Yards, Inc., Philadelphia, plans an abattoir to cost $1,000,000. The Philadelphia Suburban Counties Gas & Electric Company, Philadelphia, will build a substation at Wyncote, Pa., to cost $75,000. The Elkland Tanning Co., Elkland, Pa., will build an addition to its tannery to cost $75,000. The Mayer Aircraft Corporation, Bridgeville, Pa., plans an aircraft plant to cost $100,000. Easton, Md., plans an ornamental lighting system. The United Engineers & Constructors, Inc., Philadelphia, will build a power plant for the Gulf States Paper Corporation at Holt, Ala., to cost $750,000. The Bureau of Yards and Docks, Navy Department, Washington, is asking bids (no closing date stated) for power plant equipment for the naval station at Quantico, Va. (Specification 5602.)

Improvement Continues in Middle West

Business in the Middle West continues to improve. Industrial activity is somewhat spotty but improving as the year goes on. The steel and automotive industries are prosperous. A great deal of construction work is going on, particularly among the utility companies. Interesting items ordered include 30 600-amp. and six 1,200-amp. solenoid-operated oil circuit breakers, twenty potential transformers, two "Rossman" variable speed drive units and $250,000 worth of "Mazda" lamps. Jobbers' sales are increasing steadily. Most appliances continue to move in fair volume, particularly washing machines, one jobber placing an order for 500 machines. Construction projects are as follows:

The Columbia Mills, Inc., Chicago, plans an addition to its textile mill to cost $225,000. The Furst-McNess Company, Freeport, Ill., plans an addition to its chemical and drug factory, to cost $150,000. Evansville and Muncie, Ind., plan a municipal airport with lighting systems. The Kroger Grocery & Baking Company, Cincinnati, Ohio, plans a plant at Indianapolis, Ind., to cost $500,000. The United States Gypsum Company, Chicago, plans a plant at Davison Street, Detroit, to cost $400,000. The Thompson Products, Inc., Cleveland, plans improvements at its automobile equipment plant at Detroit, to cost $175,000. Pontiac, Mich., has approved a fund of $180,000, for a municipal airport, with lighting system.

The Lake Superior District Power Company, Ashland, Wis., plans a transmission line from Wakefield to Bergland, Mich. The Diller Manufacturing Company, Bluffton, Ohio, manufacturer of radio equipment, plans an addition to cost $70,000. The Chesapeake & Ohio Railway Company, Richmond, Va., plans an engine terminal and shops at Cincinnati, Ohio, to cost $2,000,000. The Cleveland Railway Harbor Company, Cleveland, plans a terminal and distributing plant, to cost $10,000,000. The Armstrong Furnace Company, London, Ohio, will build a plant at Columbus, Ohio, to cost $100,000. The Steel Products Engineering Company, Springfield, Ohio, plans an addition to cost $90,000. The Van Brunt Manufacturing Company, Horicon, Wis., plans an addition to its agricultural implement plant, to cost $150,000.

The Geuder, Paeschke & Frey Company, Milwaukee, Wis., will build an addition to its enamelware plant, to cost $100,000. The Gugler Lithographic Company, Milwaukee, Wis., plans an addition to cost $125,000. A. O. Smith Corporation, Milwaukee, Wis., will build an addition to its machinery plant, to cost $400,000. Richland Center, Wis., will receive bids until Aug. 7, for one high pressure condensing steam turbo-generating unit with auxiliaries, including cooling tower. Elgin and Niles, Ill., and Cedar Rapids, Iowa, plan ornamental lighting systems.

Large Motor Orders Placed on Pacific Coast

The outstanding order placed on the Pacific Coast covers complete equipment for the West Stanislaus irrigation district, comprising General Electric motors and transformers and Pelton-Moody spiral pumps totaling $125,000. Other machine orders cover a 200-hp. motor for tunnel construction work in an East Bay utility district and a total of about 700 assorted transformers from various power companies for distribution service, with sizes 15 kva. and 20 kva. running high in proportion.

Manufacturers report excellent business from the Hawaiian Islands, particularly in spare parts for plantation machinery. Large prospective business covers a match factory to be located on the Peninsula, and a building for Los Angeles, each involving $1,000,000. Contractor business averages fairly well, the average being brought up by a few exceptionally large jobs. In the northwest section of the Pacific Coast $250,000 worth of equipment was purchased from the General Electric Co. for the Weyerhaeuser lumber mill at Longview, Washington. A Seattle jobber also reports the sale of 46 machines from 75 hp. down to a cold storage and orchard concern in eastern Washington. Other motor sales included about 80 machines, mainly small sizes for irrigation and small industrial plants.

The sale of a 4,000-kw. turbine for a 50-ton paper plant at Hoquiam was reported and specifications are said to be ready for motor and other electrical apparatus for the same plant. A lumber company in eastern Washington is taking bids for approximately 1,000 hp. in motors for a two-hundred-thousand-dollar mill and the city of Seattle has started work on the reconstruction of its Cedar Falls power line costing $100,000.

The Pacific Coast Pulp & Paper Company, Los Angeles, plans a mill at Richvale, Calif., including a power plant, to cost $500,000. Roseville, Calif., plans extensions in its municipal fire alarm system. Sacramento, Calif., plans a municipal fire alarm system. The Irvine Valencia Growers Association, Tustin, Calif., plans a packing plant to cost $100,000. Sunnyvale, Arbuckle, Monrovia, Pasadena, Madera, Oroville, and Torrance, Calif., plan ornamental lighting systems.

Activities of the Trade

Okonite Company Celebrates Fiftieth Anniversary

The 50th anniversary is being celebrated this year by the Okonite Company, New York. As a feature the company collected various kinds of Okonite wire and cable which had been in service for long periods and they were on exhibit at the National Electric Light Association convention held at Atlantic City last month. The Okonite Company expressed the feeling that the business outlook for the sale of electric wire and cable is promising. The present volume of business is said to be quite satisfactory in view of the fact that a large number of companies have caught up with their big construction jobs, but with the growth of the electric light and power industry there will be a constantly increasing expansion of plant, which should provide an ample market for these products.

COPELAND PRODUCTS, INC., Detroit, manufacturer of electric refrigerators, announces a new water cooler, designed especially for spring or filter water companies to be used for rental purposes.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, 128 South Sangamon Street, Chicago, announces that R. S. Meyers has joined its sales organization and will cover the Chicago territory. Mr. Meyers was formerly with the Central Electric Company, Erie, Pa. The company also announces the appointment of M. C. Sturdy as representative in western Michigan and a part of Chicago.

THE RILEY STOKER CORPORATION, Worcester, Mass., announces that L. E. Griffith, formerly district manager of the New York office, has been appointed sales manager of the company to succeed William Pestell. W. L. Schultz, formerly sales representative of the New York office of the company, has been appointed district manager of that office to succeed Mr. Griffith.

THE STEINMETZ HEATING COMPANY, 30 Church Street, New York City, has received an order from the M. E. Bernhardt Company, Inc., New York City, manufacturer of precious metal articles, for a high temperature electric furnace for a special operation.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, 128 South Sangamon Street, Chicago, announces the following appointments of distributors for its electric ranges: Charles B. Scott Company, Scranton, Pa.; Inland Electric Company, Chicago; Danville Electric Supply Company, Danville, Ill.; Wisconsin Electrical Manufacturing Company, Milwaukee, Wis.; Universal Electric Company, Peoria, Ill.; Warren Electric Company, Sioux City, Iowa, and American Electrical Supply Company, Chicago. The company also announces new distributors for its electrical products as follows: Auto & Electric Supply Company, Inc., Baton Rouge, La.; Fife Electric Supply Company, 541 Larned Street East, Detroit; Mercantile Commercial Bank (receiver for Swanson Electric Manufacturing Company), 316 South Second Street, Evansville, Ind.; VanMeter Company, 526 Fourth Avenue, Cedar Rapids, Iowa, and Roland T. Oakes Company, Holyoke, Mass.

THE GENERAL ELECTRIC COMPANY, merchandise department, Bridgeport, Conn., announces that C. E. Wilson has been appointed assistant to the vice-president. The organization, known as the supply house division of the merchandise department, has been established as a separate department with the title Supply House Department. H. B. Tompkins will be manager, A. L. Atkinson has been made manager of the cleaner sales section, a newly established section; R. J. Heaney has been appointed manager of fan sales and D. C. Spooner, Jr., has been placed in charge of the publicity section, as acting manager.

THE HOLOPHANE COMPANY, INC., 342 Madison Avenue, New York City, announces the appointment of John James Noell as district engineer for the Southern territory with headquarters in Chattanooga, Tenn. Mr. Noell was formerly connected with the Stone & Webster engineering organization of Boston in the capacity of design electrical engineer.

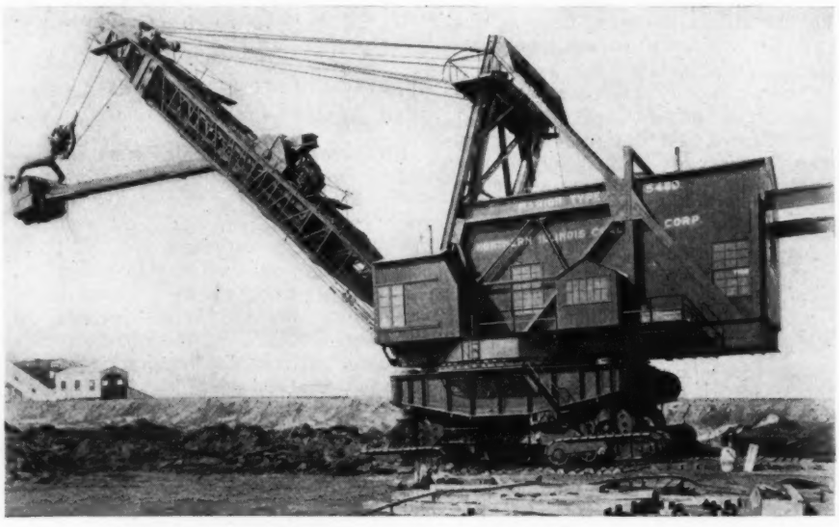
THE NATIONAL LAMP WORKS OF THE GENERAL ELECTRIC COMPANY, Nela Park, Cleveland, will hold a special meeting for jobber executives at Nela Park on Aug. 9 and 10. At this meeting mutual problems will be discussed and lighting experts will endeavor to give the jobber a better picture of the lighting industry. A series of correlated talks have been arranged.

THE ELECTRIC SPRAYIT COMPANY, South Bend, Ind., announces a new model electric "Sprayit" designed for the application of paints, enamels, varnishes, lacquers and shellac where a fine finish is necessary.

THE HENNINGSON ENGINEERING COMPANY, Twelfth and Harney Streets, Omaha, Neb., announces its removal into new quarters at 326 Union State Bank Building, Nineteenth and Farnam Streets, Omaha.

Large Electric Shovel Used in Coal Mining

A 12-cu.yd. electric stripping shovel recently was placed in operation at the Northern Illinois Coal Corporation's mine near Wilmington, Ill. An electric drag-line and an electric coal-loading shovel also were used. These excavators were built by the Marion Steam Shovel Company of Marion, Ohio. The shovel, which is shown in the illustration, uses a 90-ft. boom and a 60-ft. dipper handle. It is mounted on crawling traction trucks and is operated electrically from the power lines of the public utility company serving the territory. A 750-hp. motor drives the motor-generator set for furnishing power to the various motions and the working weight with ballast is approximately 850 tons.



A 12-cu.yd. coal mining shovel which handles more than 15,000 cu.yd. of material in a 24-hour period

The shovel operates three eight-hour shifts each day, Sundays excepted, and it has, since being placed in operation, handled 15,481 cu.yd. in a 24-hour period. This is said to exceed by far the daily production of any machine heretofore used for this class of work. It is expected that in a calendar year the shovel will handle from 2,000,000 to 3,000,000 cu.yd. of material.

New Equipment Available

Drop-Forged Insulator Caps

A line of drop-forged insulator caps for suspension type insulators, which the manufacturer claims will withstand heavy loads and greater strength tests than other kinds of hardware, has been placed on the market by the Brewer-Titchener Corporation, Cortland, N. Y. These forged insulator caps are said to be more reliable in that there are no hidden flaws or concealed weaknesses in a forging. Furthermore, these caps can be heat treated where additional strength or reduced weight is required. The caps are made from copper-bearing metal, which gives them long length of life and great rust-resisting qualities. The rust that forms on copper-bearing metal is very adherent, almost enamel-like, which stops further corrosion. To obtain greater accuracy the clevis ears or ball and socket ears are machined.

Outdoor Meter and Switch Box

The "Utility" meter and switch box which can be mounted directly on a pole without the use of a cross-arm has been placed on the market by the F. D. Kees Manufacturing Company, Beatrice, Neb. The cover of the unit forms all sides of the box except the top and back and it swings down out of the way when opened so the equipment is readily accessible. The box is made of 16-gage hot rolled steel with all joints electric welded. The instrument panel is made of selected wood $\frac{3}{4}$ in. thick. The box dimensions are 24 in. x 14 in. x 9 in.

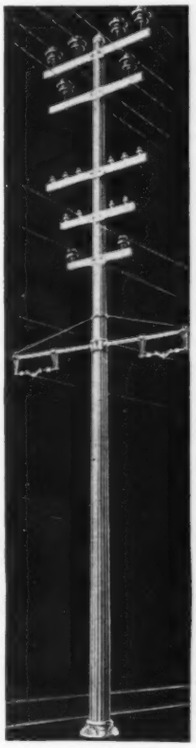
Automatic Brake for Supersynchronous Motor

An automatic brake announced by the General Electric Company for use with its supersynchronous motors eliminates the necessity for manual braking of the rotating stator. It is claimed that all the desirable features of hand braking are retained. The brake mechanism consists of an upright standard which supports a vertical shaft. The lower part of this shaft is threaded. When it is revolved it transmits motion, through a trunnion block, to a series of levers attached to the brake band. The driving motor for the brake is mounted on the side of the standard and is geared to the screw shaft. A wheel is mounted on the end of the shaft so that hand operation may be obtained at any time.

BLACKSMITH HAMMER.—The improved Blacker "B" blacksmith hammer, designed for general utility and jobbing work, has been placed on the market by the Blacker Engineering Company, New York City. The new machine is a larger and heavier unit throughout, and along with numerous dimension changes, thrust bearings are fitted to ease up the control mechanism, and a complete rearrangement of the motor drive is said to give a more compact unit.

Fluted Steel Pole

A line of steel poles made of cold-rolled steel in a fluted design and adapted for use in transmission and distribution systems has been developed by the Union Metal Manufacturing Company, Canton, Ohio. The pole is made of one or more layers of steel, as the strength requires, in a fluted design and the whole is welded to form the complete pole. The shaft of the fluted steel pole is plated both inside and out and ground line corrosion is abated by having more material at the base line.



Steel pole of fluted design

TRAFFIC CONTROL.—A new "cascade" control box for traffic light systems, announced by the General Electric Company, is designed to operate that company's three-color signals. The new box, form 57, supersedes the old form 37 cascade box and has the same outward appearance as the present forms 52 and 53 automatic mechanism boxes. In addition to the function of operating three-color signals, this box is so designed that jack-mounted relays for fire control, bell control or base floodlight control may be added.

Oil Circuit Breaker

The type "B-6" oil circuit breaker, adapted for service where a relatively compact unit for heavy alternating current at 2,500 volts or less is required, has been developed by the Westinghouse Electric & Manufacturing Company. The breaker is self-contained, the pole units, operating mechanism and control panel all being carried on a rigid steel structure arranged to mount on and bolt to the floor. The tanks can be lowered to the floor and removed from either side of the breaker. Current-carrying studs are arranged for direct bolted connection to the buses.

The standard arrangement for operating the breaker is by an electric solenoid mechanism. The moving contacts are the semi-elliptical brush type which make high pressure wiping contact. Easily renewable arcing contacts are provided to protect the main contacts.

Maximum Demand Register

The type HB Sangamo maximum demand register, placed on the market by the Sangamo Electric Company, Springfield, Ill., is said to be greatly simplified in construction and to have been developed to give the longest possible scale reading. The new maximum demand register supersedes the type HM for both single-phase and polyphase meters and is furnished for either type H2 or HC watt-hour meters. The type HB demand register is said to retain all the features of the type HM and to furnish certain additional features as a long scale reading of over 8 in. with a 300-deg. dial, a simplified arrangement of cams providing positive and rapid resetting, and a red target pusher arm indicating at all times the demand. Synchronous motor timing in this demand register is attained with the same synchronous motor originally designed and announced with the type HM demand register.

BACK-OF-BOARD KNIFE SWITCHES.—A line of type BB back-of-board knife switches has been placed on the market by the Westinghouse Electric & Manufacturing Company. They are mounted on steel panels of the dead-front type and are particularly adapted for industrial control and central-station auxiliaries. Each switch and its operating mechanism is mounted on a slate base behind the steel panel. Complete accessibility of the switch and fuses from the front of the switchboard is provided by means of a fuse door. This is interlocked with the switch handle so that the switch must be in the full open position before the fuse door can be opened and the switch cannot be closed while the door is open. These switches are available in a large number of combinations.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 3, 1928)

1,675,637. ADAPTER AND PLUG FOR CUT-OUTS; W. P. Briggs, New Bedford, Mass. App. filed Aug. 4, 1926.

1,675,649. LIGHTNING OR SURGE ARRESTER; L. C. Grant, Newcastle-Upon-Tyne, England. App. filed Oct. 5, 1925.

1,675,674. PROCESS FOR THE PRODUCTION OF CARBON ELECTRODES; I. Szarvasky, Budapest, Hungary. App. filed March 16, 1927.

1,675,677. ALTERNATING-CURRENT MOTOR; H. Weichsel, St. Louis, Mo. App. filed March 24, 1926. Self-excited synchronous motor.

1,675,680. MAGNETIC THERMAL RELAY; H. E. White, Wilkinsburg, Pa. App. filed Jan. 27, 1925.

1,675,683. SWITCH FOR REGULATORS; H. A. Woofter, Kenton, Ohio. App. filed May 24, 1926.

1,675,705. ELECTRIC WELDING MACHINE; L. H. Hoffer, Brooklyn, N. Y. App. filed April 10, 1924.

1,675,734. WELDING MACHINE; A. M. Stanley, Lynn, and J. E. Sims, Quincy, Mass. App. filed Nov. 25, 1921.

1,675,737. LOCK-CONTROLLED ELECTRIC SWITCH; E. L. Teich, New Britain, Conn. App. filed Nov. 27, 1926.

1,675,742. ELECTRODE HOLDER FOR ELECTRIC FURNACES; F. Weckerle, Munich, Germany. App. filed Aug. 28, 1925.

1,675,744. SHAFT-TYPE ELECTRIC FURNACE; T. F. Baily, Alliance, Ohio. App. filed July 19, 1927.

1,675,750. RAIL BOND; F. P. Dahlstrom and C. L. Larson, Worcester, Mass. App. filed Sept. 2, 1921.

1,675,763. HANDLE FOR PORTABLE INCANDESCENT LAMPS; C. T. McCarthy, South Weymouth, Mass. App. filed April 25, 1927.

1,675,805. ELECTRIC RAZOR; J. C. Holcomb, Sulphur Springs, Tex. App. filed Sept. 28, 1927.

1,675,828. ELECTROLYTE; H. O. Siegmund, West Orange, N. J. App. filed Dec. 29, 1924. For electrolytic condensers.

1,675,837. EXPLOSIONPROOF FITTING FOR ELECTRIC GLOWLAMPS; J. Beckmann, Altona-Ottensen, Germany. App. filed Aug. 15, 1927.

1,675,849. ALARM AND CONTROL DEVICE; M. E. Fultz, Brooklyn, N. Y. App. filed Dec. 8, 1924. For fluid flow systems.

1,675,857. WIRE CONNECTER; B. Liebowitz, Pennside, Pa. App. filed Nov. 11, 1924.

1,675,872. PERMANENT MAGNET AND METHOD OF MAKING THE SAME; J. H. White, Cranford, N. J. App. filed May 8, 1925.

1,675,884. MAGNETIC MATERIAL; G. W. Elmen, Leonia, N. J. App. filed May 29, 1926.

1,675,897. SAFETY ELECTRIC CONTROL DEVICE; I. E. McCabe, Chicago, Ill. App. filed June 4, 1925.

1,675,918. HIGH-TENSION CABLE; R. W. Atkinson and G. J. Shurts, Perth Amboy, N. J. App. filed May 9, 1923.

1,675,921. MEANS FOR MOUNTING ELECTRICAL FITTINGS; S. N. Buchanan, New York, N. Y. App. filed Jan. 6, 1927.

1,675,942. OUTLET-BOX SUPPORT; C. A. Lundberg, Chicago, Ill. App. filed Feb. 11, 1926.

1,675,960. ALTERNATING-CURRENT INDUCTION MOTOR; L. Schon, Essen, Germany. App. filed March 7, 1925.

1,675,973. BATTERY CELL; H. Csanyi, New York, N. Y. App. filed Sept. 17, 1924.

1,675,978. STORAGE BATTERY; R. A. Klock, Rockaway Beach, and T. B. Entz, Brooklyn, N. Y. App. filed Dec. 23, 1922.

1,675,989. ANNUNCIATOR SYSTEM; L. E. Oneal, East Orange, N. J. App. filed Nov. 27, 1922. Especially applicable to power plants and the like.

1,675,991. BATTERY CONNECTER; J. Poland, Cascade, Mont. App. filed Feb. 11, 1922.

1,676,006. ANTI-OSCILLATING AND STRESS-REDUCING DEVICE FOR CABLES; L. H. Crook, Washington, D. C. App. filed Oct. 18, 1926.

1,676,007. BATTERY CELL; H. Csanyi, New York, N. Y. App. filed May 26, 1926.

1,676,028. ELECTRIC TRANSMISSION; J. A. Heany, New Haven, Conn. App. filed Dec. 1, 1919. Power transmission from a prime mover to a driven member.

1,676,050. RHEOSTAT; T. Rhodus, Chicago, Ill. App. filed Dec. 18, 1925.

1,676,077. MOTOR-STARTING SWITCH; A. C. Bunker, Montclair, N. J. App. filed Jan. 28, 1924. Automatic.

1,676,079. SWITCH SOCKET; G. M. Condit, Waterville, Conn. App. filed Oct. 17, 1925.

1,676,098. STEAMING IRON; R. Leprestre, New York, N. Y. App. filed March 15, 1928.

1,676,122. FUSE PLUG; J. N. Weibeler, Belle Plaine, Minn. App. filed March 16, 1927.

1,676,123. ARRANGEMENT OF 6N-POLE WINDINGS; H. Weinert, Dresden-Kotzschenbroda, Germany. App. filed July 9, 1926.

1,676,143. CIRCUIT BREAKER; M. S. Hoban, London, England. App. filed Sept. 20, 1926.

1,676,155. CIRCUIT BREAKER AND CLOSER; F. A. Pfeifer, Springfield, Ohio. App. filed March 16, 1927.

1,676,195. APPARATUS FOR TESTING COILS; J. F. MacWilliams, Cresson, Pa. App. filed Oct. 28, 1924.

1,676,208. CABLE SUPPORT; D. E. Replogle, Watertown, Mass. App. filed Dec. 2, 1926. To protect the surface coating of cables in the region adjacent the entrance or exit of a cable conduit or duct.

(Issued July 10, 1928)

1,676,239. HOUSING CONSTRUCTION; R. B. Benjamin, Chicago, Ill. App. filed June 11, 1923. Service box.

1,676,254. HUSK OR SOCKET HOUSING; V. R. Despard, Valparaiso, Ind. App. filed March 7, 1924.

1,676,255. LIQUID-QUANTITY-INDICATING DEVICE; A. Dittlinger, E. V. Dittlinger, Jr., and N. Dittlinger, St. Louis, Mo. App. filed May 5, 1924.

1,676,257. ELECTRIC SWITCH; T. C. Forbes, Hopkins, Minn. App. filed May 19, 1926.

1,676,280. LAMP SOCKET ASSEMBLY; G. F. Niemann, Chicago, Ill. App. filed July 30, 1924.

1,676,282. PRESSURE CONTROL FOR ELECTRIC WELDING; G. H. Phelps, Warehouse Point, Conn. App. filed March 5, 1927.

1,676,300. INCANDESCENT ELECTRIC LAMP; A. Sved, New York, N. Y. App. filed Feb. 21, 1927.

1,676,302. EXHAUST MACHINE FOR HIGH VACUUM WORK; J. M. van der Poel, Eindhoven, Netherlands. App. filed April 8, 1926.

1,676,312. ELECTRIC SHIP PROPULSION; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 16, 1922.

1,673,313, 1,676,314, 1,676,315, 1,676,316. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Schenectady, N. Y. Apps. filed June 27, 1922, Nov. 23, 1922, Oct. 3, 1923, Aug. 25, 1924.

1,676,323. ELECTRIC-LAMP LOCK; S. A. Clemetson and O. H. Rasmussen, Iron Mountain, Mich. App. filed May 21, 1927.

1,676,340. INTERLOCKING RELAY; J. C. Lindner, Rochester, N. Y. App. filed April 30, 1923.

1,676,380. ECCENTRICALLY-PIVOTED ARMATURE MOUNTING FOR VIBRATORY UNITS; G. F. Borkman, Salt Lake City, Utah. App. filed March 31, 1926.

1,676,387. BATTERY CONNECTER; A. C. DeLorme, Newark, N. J. App. filed Oct. 14, 1927.

1,676,388. MOTOR STARTER; C. T. Evans, Milwaukee, Wis. App. filed Oct. 2, 1924.

1,676,408. MERCURY SWITCH; J. P. O'Shea, New York, N. Y. App. filed Nov. 21, 1923.

1,676,417. ELECTRICAL CONDENSER; E. S. True, Oak Park, Ill. App. filed Aug. 9, 1923.

1,676,433. LOW VOLTAGE SWITCHING MECHANISM; A. J. Evers, Chicago, Ill. App. filed April 8, 1926.

1,676,435. MULTIPLE LAMP SOCKET; I. F. Giles, Yonkers, N. Y. App. filed June 15, 1925.

1,676,439. THREE-WAY ELECTRIC PLUG; W. Ile, Little Falls, N. J. App. filed March 19, 1925.

1,676,466. ELECTRICAL RELAY FOR INTERMITTENT CLOSURE; C. S. Snavely, Pittsburgh, and W. B. Wells, Wilkinsburg, Pa. App. filed May 12, 1924.

1,676,486. CONDUIT FOR ELECTRIC CONDUCTORS; O. A. Frederickson, Hartford, Conn. App. filed May 4, 1923.

1,676,510. ELECTRICAL WATER HEATER; H. C. Welcomer, Steelton, Pa. App. filed Aug. 25, 1927.

1,676,545. INDUCTION FURNACE; R. Gross, Hohenneuendorf, near Berlin, Germany. App. filed June 16, 1927.

1,676,584. MEANS FOR STRINGING CONDUCTORS; S. N. Tideman, Wilmette, Ill. App. filed Feb. 18, 1926.

1,676,585. LOCKING COUPLING; T. B. Tiefenbacher, North Elizabeth, N. J. App. filed Oct. 28, 1925.

1,676,608. BATTERY SWITCH; H. Hubbell, Jr., Bridgeport, Conn. App. filed Nov. 14, 1925.

1,676,632. METHOD OF AND APPARATUS FOR TESTING MAGNETIZABLE OBJECTS; C. W. Burrows, New York, N. Y. App. filed Jan. 4, 1924.

New Trade Literature

STRAND.—The Page Steel & Wire Company, Bridgeport, Conn., is distributing a booklet which is a reference book on the principal uses of strand and the grade for various applications. Tables of common wire gages and of strand wire areas and weights are included. A description of the new Page preformed strand is given.

VACUUM-TUBE SYNCHRONIZING EQUIPMENT.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-777A covering its vacuum-tube synchronizing equipment such as bushings equipped with capacitance transformers, outdoor amplifiers and indoor amplifier assembly, including motor-generator set and synchroscope. Illustrations and dimensions of the equipment are included. This bulletin supersedes GEA-777.

LIGHTING UNIT. — "Holophane Wide Spread Light for Outdoor Use" is the title of a pamphlet issued by the Holophane Company, Inc., 342 Madison Avenue, New York City, in which it describes a new lighting unit for outdoor use.

EXPANSION ANCHORS, ETC. — The James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis, has issued bulletins No. 301, 310 and 320 describing and illustrating respectively its "Hi-tension" four-in-one expansion anchors, its solderless service connectors and its guy wire clips.

SOLENOID BRAKES, MOTOR-DRIVEN MINE HOISTS, ETC.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-753-A describing the CR9516 shoe-type solenoid brakes for alternating and direct-current motors. The company also is distributing the following bulletins: GEA-964, entitled "Motor-Driven Mine Hoists," in which it gives a partial list with many illustrations of mine hoist motors supplied by the company; GEA-751, covering its combination trolley wire suspension and guard board support for mines, and GEA-866A, describing its choke coils for railway signal high-voltage power lines.

GLASS COVER FOR REFLECTORS.—The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, has published a bulletin describing and illustrating the new Benjamin dust-tight glass cover for industrial reflectors.

ANCHORS.—The W. N. Matthews Corporation, 3722 Forest Park Boulevard, St. Louis, has issued new price sheets covering its "Scrulix" anchors and installing tools, its "Xpandix" anchors and its "Traplox" anchors.

SHEET STEEL.—The Empire Steel Corporation, Mansfield, Ohio, is distributing a booklet entitled "Standard Differentials and Extras," covering the various sheet steels that they manufacture. It also contains sheet weights and bundling tables.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Weltevreden, Java (No. 32,236), for low-priced storage batteries, electric ignition cable for automobiles and incandescent lamps.

An agency is desired in Munich, Germany (No. 32,255), for electrical appliances.

An agency is desired in Vienna, Austria (No. 32,298), for household electrical appliances and portable electric tools.

An agency is desired in Vancouver, Canada (No. 32,251), for household electrical appliances and wiring supplies.

An agency is desired in The Hague, Netherlands (No. 32,254), for household and restaurant electrical devices.

Purchase is desired in Saloniki, Greece (No. 32,253), of telephone wire, phosphor bronze, porcelain insulators and pole line hardware.

Three important projects involving hydroelectric works on the Danube are being studied by the Austrian government. Details are available under reference Austria No. 281,897.